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April 15, 1989

Energy Research Abstracts

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UNITED STATES DEPARTMENT OF ENERGY

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ENERGY RESEARCH ABSTRACTS

ABOUT THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

The Department of Energy's Scientific and Technical Information Program (STIP) is carried out at many levels within the Department and by its contractor organizations. The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, provides direction and leadership for STIP and serves as DOE's national center for scientific and technical information management and dissemination. Both DOE-originated information and worldwide literature regarding advances in subjects of interest to DOE researchers are collected, processed, and disseminated through the Energy Data Information System (EDIS) maintained by OSTI. The major data bases in this system are available within the United States through commercial on-line systems and to those outside the United States through formal governmental exchange agreements. The current-year records for the major data bases plus a number of specialized data bases are available to DOE offices and contractors through OSTI's Integrated Technical Information System (ITIS). To manage DOE's information resources effectively, DOE's Scientific and Technical Information Program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. Foreign information is obtained through the International Energy Agency's 13-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. **Please note that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.**

ERA is comprehensive in its subject scope, encompassing DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

Information in *ERA* is available for on-line searching as part of the Energy Data Base. The current-year records are available on the Integrated Technical Information System (ITIS). The entire data base is available through commercial on-line vendors.

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ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for 24 semimonthly issues is $184.00 for domestic subscribers and $230.00 for foreign subscribers. A single issue costs $27.00, domestic, or $33.75, foreign. Cumulative indexes are available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

Managing Editor, Audrey B. Smith
Technical Editor, M. Catherine Grissom

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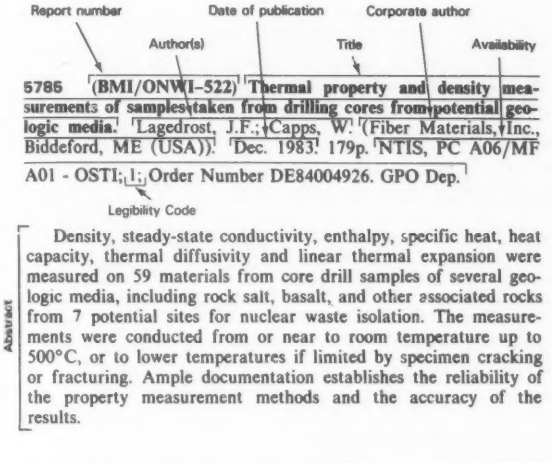
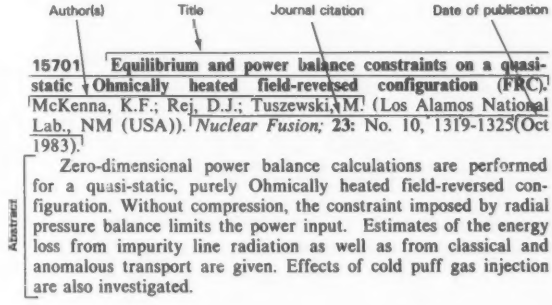
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Author(s)
Date of publication
Corporate author
Title
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01 - OSTI; 1; Order Number DE84004926. GPO Dep.
Legibility Code
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS Order Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9: 15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order number–report number correlation is included for convenience.

BMI/ONWI-522	9:5785	NTIS, PC A09/MF A01. OSTI Order Number DE84004926, Distribution Category MN-70

INFORMATION SOURCES

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

The **Energy Technology Data Exchange (ETDE)** was established by the International Energy Agency to promote cooperation among members in conducting appropriate energy-related research and development programs through the development of a formal central information sharing system. In accomplishing the objectives of the ETDE, members select, abstract, and index relevant research information published in their countries in accordance with Exchange standards. OSTI serves as the central receiving and processing center for this information, which it then disseminates to national centers in the participating countries. The following countries are currently members of the ETDE:

Canada
Denmark
Finland
France
Federal Republic of Germany
Italy
Japan
The Netherlands
Norway
Spain
Sweden
United Kingdom
United States

The **International Nuclear Information System (INIS)** was established to promote the exchange of information on nuclear science and technology. Its operation is similar to that of the ETDE, with the INIS Secretariat being located in Vienna, Austria. Currently, 75 countries and 14 international organizations are members of INIS. OSTI serves as the INIS national center for the United States.

In the exercise of its rights and responsibilities under the agreements to which it is a party, OSTI both receives information from the above sources and submits U.S.-produced information to them. In addition to materials generated by the Department of Energy, this U.S.-produced information is gathered from other government agencies as well as under contract with private information processing companies. All input is computer processed and entered into a data base for on-line retrieval. The data base serves as well for the production of numerous OSTI publications.

SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 289 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R6.

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REFER ALSO TO CITATION(S) 12508

12503 (DOE/FE—0114) Comprehensive report to Congress: Proposals received in response to the innovative clean coal technology program opportunity notice. (USDOE Assistant Secretary for Fossil Energy, Washington, DC). Oct 1988. 221p. NTIS, PC A10/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006384/JAW.

This report is a comprehensive overview of the projects selected and all proposals received in response to the Program Opportunity Notice for Innovative Clean Coal Technology Demonstration Projects (solicitation number DE-PS01-88FE61530) issued by the US Department of Energy on February 22, 1988. Through this Program Opportunity Notice (PON), the Department of Energy (DOE) solicited proposals to conduct cost-shared innovative clean coal technology projects to demonstrate technologies that are capable of being commercialized in the 1990s, that are more cost-effective than current technologies, and that are capable of achieving significant reduction of sulfur dioxide (SO_2) and/or nitrogen oxide (NO/sub x/) emissions from existing coal-burning facilities, particularly those that may contribute to transboundary and interstate air pollution.

12504 (DOE/PC/79905—2) Fundamental research on surface science of coal in support of physical beneficiation of coal: Quarterly report No. 2, January 1-March 31, 1988. Good, R.J. (State Univ. of New York, Buffalo (USA). Dept. of Chemical Engineering). 1988. Contract AC22-87PC79905. 10p. NTIS, PC A02/MF A01. Order Number DE88017220/JAW.

This project is an investigation of the fundamental surface science that underlies the Otisca T process of coal beneficiation. It is intended that modifications of the process will result, which will increase the efficiency and the range of utilization of the Otisca T process.

12505 (DOE/PC/81210—T20) Development and demonstration of a static tube flotation system for production of superclean coal: Final technical report. Yang, D.C. (Michigan Technological Univ., Houghton (USA). Inst. of Materials Processing). 12 Oct 1988. Contract AC22-85PC81210. 153p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002866/JAW.

The primary objective was to apply the MTU flotation technology to produce a superclean coal (i.e., 0.4%-1.0% ash), which may be combusted in oil-fired power plants. The objective was achieved with one of the two selected major US bituminous coals, Lower Kittanning seam, in both laboratory and 500 lb/hr process development unit (PDU) tests. With Pittsburgh seam coal, a 2 to 4% ash clean coal was produced. Failure to achieve the target ash level with the Pittsburgh seam coal was most likely due to insufficient liberation of mineral matter even at 500 mesh. The superclean coal was produced from Lower Kittanning coal in a single stage of tube flotation. This shows a significant improvement over conventional flotation, which requires at least 4 to 6 stages to approach similar results. Efficiencies of separation on eight coals of varying rank and origin were determined. The effects of coal parameters such as ash content, ash mineralogy, and ash mineral liberation size on the economics of superclean coal production were also established. The static tube flotation technology produced a separation efficiency, depending on the feed coal characteristics, equal to or better than heavy liquid separation efficiency. An economic analysis revealed that static tube flotation is superior to conventional flotation cells for efficient reduction of ash and pyritic sulfur. Furthermore, commercial packed-bed static tube flotation machines can be designed on a direct scale-up basis. 16 refs., 36 figs., 36 tabs.

0104 Processing

REFER ALSO TO CITATION(S) 12521, 12531, 12531, 12559, 12987, 13257

12506 (CONF-8810170—2) Overview of the Advanced Research and Technology Development Fossil Energy Materials Program. Judkins, R.R. (Oak Ridge National Lab., TN (USA)). 5 Oct 1988. Contract AC05-84OR21400. 35p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003933/JAW.

From DOE direct liquefaction contractor's conference; Pittsburgh, PA, USA (4 Oct 1988).

The AR and TD Materials Program is directed toward obtaining a fundamental understanding of materials and their behavior in fossil energy systems. Long-range needs of fossil energy systems are addressed on the program and funded projects should have general applicability to several fossil energy technologies. Three research thrust areas are included in the program: structural ceramic composites, alloy development and mechanical properties, and corrosion and erosion of alloys. A programmatic activity on assessments and technology transfer is included. Principal activities on the structural ceramic composites research thrust area include the development of processes for making silicon carbide whiskers, and incorporating whiskers into ceramic matrix composites. Two major alloy development projects are being conducted. The first of these is the development of iron aluminides. The primary development effort on the aluminides has led to the identification of alloy compositions with combined high-temperature strength and corrosion resistance. The second alloy development project is the development and evaluation of iron-base alloys for advanced coal combustion heat exchange systems. Corrosion research centers on studies of the formation and breakdown of protective oxide scales, particularly in sulfur-containing atmospheres. Erosion and wear research is directed to the understanding of modes of material erosion and their relationships to materials properties. 28 refs., 4 figs., 1 tab.

12507 (DOE/CH/10088—T1) Great plains coal gasification plant: Technical lessons learned report. Delaney, R.C.; Mako, P.F. (Fluor Engineers, Inc., Irvine, CA (USA). Advanced Technology Div.). Nov 1988. Contract AC02-82CH10088. 38p. NTIS, PC A14/MF A01 - OSTI. Order Number DE89003619/JAW.

In a first of a kind, grass roots plant of the complexity of the Great Plains Gasification Plant the lessons learned are numerous and encompass a wide range of items. This report documents the lessons learned from all phases of the project from preliminary design through the most recent operation of the plant. Based on these lessons learned, suggestions are made for changes and/or process improvements to future synfuel plants. In addition, recommendations are made for research and development in selected areas. 46 refs., 31 figs., 33 tabs.

12508 **(DOE/PC/79806—6) Characterization and suitability of superclean coals for hydroliquefaction feedstocks: Technical progress report, October 1, 1988--December 31, 1988.** Kim, N.K. (Michigan Technological Univ., Houghton (USA). Dept. of Chemistry and Chemical Engineering). 2 Jan 1989. Contract FG22-87PC79806. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005024/JAW.

The objective of the research is to evaluate the effect of superclean coals as produced from various domestic coals, using MTU's flotation technology on direct coal liquefaction. The micronized and successively clean coals range from 1.0% to 20% in ash content and contain various sulfur concentrations. They are to be assessed as coal conversion feedstocks. Thus, the proposed project will evaluate the effects of ash, sulfur, and ultrafineness of coal feed on the hydroliquefaction process. Several runs were carried out at lower temperatures and various reaction times. The reaction temperatures were programmed to change from 350 C to 425 C for one run, and in reverse order for another run. In general, the liquid product yields were worse than those obtained from the standard operating conditions (475 C for 2 hrs). 1 ref., 7 figs., 6 tabs.

12509 **(DOE/PC/79816—1) Slurry phase Fischer-Tropsch synthesis: Cobalt plus a water-gas-shift catalyst: Report for inception to June 30, 1988.** Yates, I.; Satterfield, C.N. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemical Engineering). 1988. Contract AC22-87PC79816. 67p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004366/JAW.

According to patents from Shell a mechanical mixture of a cobalt catalyst and a $Cu/Zn/Al_2O_3$ has been used successfully in a fixed-bed reactor to carry out Fischer-Tropsch synthesis with a low H_2/CO feed. In our slurry reactor, however, we encounter substantial deactivation with the $Cu/Zn/Al_2O_3$ catalyst when combined with a Co catalyst. A detailed and critical literature review was made of water-gas-shift catalysts. Activation procedures are critically important. Reports of poor performance by other researchers seem to stem from use of too high reduction temperatures and/or improper procedures for catalyst preparation. We have been using commercial catalysts and recommended activation procedures. The slow deactivation we observed may be associated in some way with the use of a slurry reactor instead of fixed bed. 55 refs., 13 figs., 9 tabs.

12510 **(DOE/PC/79928—T4) Solid superacids as coal liquefaction catalysts: Quarterly report, July--September 1988.** Tierney, J.W.; Wender, I. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). 1988. Contract FG22-87PC79928. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005378/JAW.

This research aims at exploring the possibility of mild coal liquefaction in the presence of solid superacids, especially SO_4^{2-} modified oxides of iron, zirconium and titanium. Fe_2O_3/SO_4^{2-} is known to be an impressive active catalyst in coal conversion at 400{degree}C[4]. Our objective is to find conditions under which Fe_2O_3/SO_4^{2-} and similar systems catalyze the conversion of coal at lower temperatures. So far, we have synthesized Fe_2O_3/SO_4^{2-}, ZrO_2/SO_4^{2-} and TiO_2/SO_4^{2-} catalysts and characterized them by XRD, BET and acidity measurements. We concentrated on ir studies of these solid acids as well as their use in a test reaction, namely isomerization of n-pentane. 9 refs., 2 tabs.

12511 **(DOE/PC/79933—T5) Effectiveness factors for hydroprocessing of coal and coal liquids: Progress report No. 5, September 15, 1988--December 14, 1988.** Massoth, F.E.; Seader, J.D. (Utah Univ., Salt Lake City (USA)). 6 Jan 1989. Contract FG22-87PC79933. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005422/JAW.

The aim of this project is to develop a methodology to predict, from a knowledge of feed and catalyst properties, effectiveness factors for catalytic hydroprocessing of coal and coal liquids. To achieve this aim, it is necessary to account for restrictive diffusion. The research entails a study of hydrodenitrogenation of model compounds and coal-derived liquids using three NiMo/alumina catalysts of different pore size to develop, for restrictive diffusion, a relationship that can be used for estimating reliable effectiveness factors. Measurements of coronene diffusivities at ambient conditions in NiMo catalysts and their alumina supports were carried out. Hydrodenitrogenation (HDN) runs with indole were continued in the batch reactor mode to evaluate catalyst tortuosities. Several runs were made with thiophene and hexene in a fixed bed-reactor under gas-phase conditions to assess intrinsic activities of the catalysts. 5 refs., 3 figs., 4 tabs.

12512 **(DOE/PC/81207—T1) Microbially mediated removal of organic sulfur from coal: Final technical report.** (ARCTECH, Inc., Alexandria, VA (USA)). May 1988. Contract AC22-85PC81207. 158p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89001572/JAW.

The goals of this project were to develop a microbial coal cleaning process capable of removing a significant fraction of the organic sulfur from coal by optimization of desulfurization using CB1, development of additional microorganisms capable of removing other organic sulfur forms from coal, and to evaluate combined desulfurization using CB1 and CBX to decrease organic sulfur in coal. Optimization studies defined more precisely the conditions required to achieve maximum desulfurization of coal by CB1. No significant differences in desulfurization were noted when coal was ground in a dry mill or in a stirred (wet) ball mill. Desulfurization increased with decreasing particle size. Solids loadings were not found to be limiting when the optimal particle size, retention time and microorganism-to-coal dose were used. The minimum retention time and microbe-to-coal ratios resulting in maximum sulfur removal were determined. A second microorganism, CB2, was selected and characterized. CB2 is capable of removing sulfur from the aryl sulfide model compound, diphenyl sulfide (DPS). Combining the activity of CB1 and CB2 for desulfurization of coals was investigated. The sulfur removing activity(ies) for each microbe was (were) determined to reside in the chromosomal DNA rather than in extrachromosomal, plasmid DNA. Simultaneous growth of the microorganisms for treatment of coal, simultaneous treatment of coal using microbes grown separately, and sequential treatment of coal were investigated. 11 refs., 13 figs., 57 tabs.

12513 **(DOE/PC/88806—T1) Cooperative research in coal liquefaction infratechnology and generic technology development: Quarterly report, May 1, 1988--July 31, 1988.** Huffman, G.P.; Sendlein, L.V.A. (Consortium for Fossil Fuel Liquefaction Science, Lexington, KY (USA)). 1988. Contract FC22-88PC88806. 95p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003427/JAW.

Results of research programs in coal liquefaction are presented. Areas of research include: desulfurization by bioprocessing; characterization of coal liquefaction processes by XAFS spectroscopy; coprocessing of coal with heavy oil and petroleum residuals; liquefaction research in pyrolysis, catalysis and coal dissolution; novel catalysts; data base development; resource evaluation; depolymerization; solvent extraction and chromatography; correlations of liquefaction yields and coal structure. Individual projects are processed separately for the data bases. (CBS)

12514 **(DOE/PC/90528—T5) Thermodynamics of coal liquid/solid systems: Progress report, March 16, 1988--September 15, 1988.** Holder, G.D. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Oct 1988. Contract FG22-86PC90528. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number TI89004319/JAW.

Thermodynamic data for many organic systems have been developed for the petroleum industry. This data, however, is limited to the paraffinic compounds, while the liquids produced in coal liquefaction are highly aromatic and may contain heteroatoms such as sulfur, oxygen and nitrogen. An effort to generate data bases for these aromatic compounds has been recently made. One of the goals of this work is to expand the data bases so that the properties of coal liquefaction products are accurately determined. 21 refs., 1 fig.

12515 **(EPRI-CS—6015) Workshop proceedings on defining coal handleability: Its cost impact and control.** Arnold, B.J. (Electric Power Research Inst., Palo Alto, CA (USA); Kaiser (Raymond) Engineers, Inc., Homer City, PA (USA)). Nov 1988. 128p. (CONF-8704338—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004097/JAW.

From Workshop on defining coal handleability: its cost impact and control; Lexington, KY, USA (30 Apr 1987).

This report contains the proceedings of an EPRI-sponsored workshop held in Lexington, Kentucky, on April 30--May 1, 1987. This workshop reviewed the causes and costs of coal handling problems, as well as some nontraditional techniques to control these problems. Speakers presented information on bin design, laboratory measures of coal handling, frozen coal, dust control, induced vertical flow techniques and a self-unloading train. The workshop's goal was to involve utility coal buyers, design engineers, coal suppliers and power plant engineers in framing a research project to measure and predict the handling characteristics of particular coals. Individual projects are processed separately for the data bases. 50 refs., 57 figs., 4 tabs.

12516 **(PB—89-129183/XAB) Evaluation of ideal catalyzed gasification at low temperatures for making pipeline gas from western subbituminous coal. Topical report, August 1987-March 1988.** Sandler, H.S.; Smelser, S.C. (Fluor Technology, Inc., Irvine, CA (USA)). Mar 1988. 224p. NTIS, PC A10/MF A01.

First-pass designs and cost estimates were developed for three idealized gasification plants that convert western subbituminous coal to pipeline gas. A throw-away catalyst was conceptualized for the three 'ideal' gasifiers to promote the gasification of coal directly to methane at low temperatures. Overall performance and economics for the three plants were compared to show that the cost of gas and the plant efficiency for an ideal plant are not significantly impacted by the choice of steam or water feed to the gasifiers. Gasifiers designed to operate at lower temperatures with improved approaches to equilibrium will improve plant efficiency and reduce the cost of gas. There is incentive to develop a catalyst that promotes gasification at temperatures below that required for KRW gasifiers.

12517 **(PB—89-129191/XAB) Design and economics of a coal-to-pipeline-gas facility using KRW gasifiers with reduced carbon conversion. Topical report, August 1987-January 1988.** Earley, P.I.; Smelser, S.C. (Fluor Technology, Inc., Irvine, CA (USA)). Jan 1988. 132p. NTIS, PC A07/MF A01.

The objective of the study was to assess the magnitude of the economic benefit or penalty associated with reducing the carbon conversion of KRW gasification in a plant designed to produce a pipeline gas from eastern bituminous coal. The results of the study indicate that reducing the carbon conversion of KRW gasification in a pipeline plant may not provide an economic advantage over a plant based on KRW gasification with a high carbon conversion, but there is no penalty associated with low carbon conversion.

12518 **(PNL-SA—16459) Microbial solubilization of coals.** Campbell, J.A.; Fredrickson, J.K.; Stewart, D.L.; Thomas, B.L.; McCulloch, M.; Wilson, B.W.; Bean, R.M. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 22p. (CONF-881205—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005160/JAW.

From Gas, oil and coal biotechnology symposium; New Orleans, LA, USA (5 Dec 1988).

Microbial solubilization of coal may serve as a first step in a process to convert low-rank coals or coal-derived products to other fuels or products. For solubilization of coal to be an economically viable technology, a mechanistic understanding of the process is essential. Leonardite, a highly oxidized, low-rank coal, has been solubilized by the intact microorganism, cell-free filtrate, and cell-free enzyme of {ital Coriolus versicolor}. A spectrophotometric conversion assay was developed to quantify the amount of biosolubilized coal. In addition, a bituminous coal, Illinois No. 6, was solubilized by a species of {ital Penicillium}, but only after the coal had been preoxidized in air. Model compounds containing coal-related functionalities have been incubated with the leonardite-degrading fungus, its cell-free filtrate, and purified enzyme. The amount of degradation was determined by gas chromatography and the degradation products were identified by gas chromatography/mass spectrometry. We have also separated the cell-free filtrate of {ital C. versicolor} into a $<10,000$ MW and $>10,000$ MW fraction by ultrafiltration techniques. Most of the coal biosolubilization activity is contained in the $<10,000$ MW fraction while the model compound degradation occurs in the $>10,000$ MW fraction. The $>10,000$ MW fraction appears to contain an enzyme with laccase-like activity. 10 refs., 8 figs., 5 tabs.

0106 Properties

REFER ALSO TO CITATION(S) 12514, 12515, 12536, 12554, 12560, 12987, 13262

12519 **(CONF-8809194—1) Development of a refractive index matched test facility for solid-liquid flow studies using laser velocimetry and some initial results, September 1, 1986--February 28, 1989.** Kadambi, J.R.; Dybbs, A.; Edwards, R.V.; Bhunia, S.; Chen, R.C. (Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Mechanical and Aerospace Engineering). 1989. Contract FG22-86PC90961. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003413/JAW.

From Solids transport contractor review meeting; Pittsburgh, PA, USA (1 Sep 1988).

This paper describes a refractive index matched test facility for the study of solid-liquid multiphase flows encountered in fossil fuel processes. Some initial results are also discussed. The coal-water slurry flows are simulated in this facility. The test facility will be used to gain a better understanding of the particle-particle, particle-fluid, and particle-wall interactions. In part, this will be accomplished by using laser anemometry to simultaneously measure the fluid velocities and the particle velocities. To make these measurements, a matched index of refraction flow system has been constructed. Silica gel was chosen to simulate the coal phase and sodium iodide to simulate the water phase. With this combination, refractive index matching can be obtained with silica gel concentrations in excess of 40% by volume. 10 refs., 15 figs., 2 tabs.

12520 **(DOE/PC/70795—T10) The macromolecular chemistry of coalification: Final report.** Larsen, J.W.; Wei, You-Ching; Kovac, J.; Shawver, S.E.; Moore, C.E. (Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry; Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 15 Dec 1988. Contract FG22-84PC70795. 54p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004347/JAW.

There were four main objectives of this project: (1) to develop experimental techniques for measuring the molecular weight distributions of the extractable material in coals, (2) extend the solvent swelling techniques developed by Green, Kovac and Larsen for the study of the macromolecular structure of bituminous coals to lower rank coals, (3) further develop the theoretical methods for interpreting solvent swelling measurements on coals, and (4) develop a theoretical model of macromolecular network formation and degradation which might describe the geochemical process of coal formation. Progress was made on the first three objectives, and these results will be described in this report. It was not possible to develop the theoretical model of network formation and degradation, which was the fourth objective of the research. 42 refs., 15 figs., 5 tabs.

12521 **(DOE/PC/79917—T4) NMR investigation of supported metal catalysts for syngas conversion: Quarterly technical progress report 4.** (Grambling State Univ., LA (USA)). 20 Jan 1989. Contract FG22-87PC79917. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006322/JAW.

NMR investigations of cobalt with and without catalyst supports of titania and thoria are presented. 8 refs., 3 figs., 2 tabs. (CBS)

12522 **(DOE/PC/80517—T13) Improving the stability of coal slurries: Quarterly progress report for the period June 15, 1988--September 15, 1988.** Fogler, H.S. (Michigan Univ., Ann Arbor (USA). Dept. of Chemical Engineering). 1988. Contract FG22-85PC80517. 24p. NTIS, PC A03/MF A01 - OSTI; GPO Dep. Order Number DE89004832/JAW.

Our previous studies have shown that colloidal particles can be sterically stabilized by adsorbed acidic polysaccharides such as gum tragacanth, GT and poly (galacturonic acid), PGUA. In order to directly observe steric repulsive forces between two surfaces, the forces between atomically smooth mica sheets bearing the acidic polysaccharides were measured using the Surface Force Apparatus designed by Israelachvili and Adams. In addition, the steric layer thickness measured by photon correlation spectroscopy, PCS was compared with the thickness at which forces begin to arise. This comparison is essential because Tadros indicated in his rheological experiments that the steric layer thickness measurements by PCS tend to underestimate the thickness at which forces begin to arise and our interpretation of effects of pH, molecular weight and surface charge on stability is based on the steric layer thickness measured by PCS. 18 refs., 7 figs , 4 tabs.

12523 **(DOE/PC/90502—8) Catalyst accessibility in high volatile bituminous coal: Quarterly report.** Kispert, L.D. (Alabama Univ., University (USA). Dept. of Chemistry). Oct 1988. Contract FG22-86PC90502. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number TI89003393/JAW.

As reported previously we are making use of an EPR technique developed in this lab to determine the pore size and number distribution in high volatile bituminous coal using nitroxide spin probes of different sizes, shapes, and reactivity. This year we have been studying pore size and shape distribution in Pittsburgh No. 8, Blind Canyon and Illinois No. 6 coal from the Argonne Premium Coal Program as well as in PSOC-311 (No. 6 seam, Fruitland, New Mexico) and PSOC-1354 (Illinois No. 6, Douglas County, IL) coals. We have also reported a study of the acidic and phenolic site distribution in Black Creek (Alabama) and Illinois No. 6 (Argonne Premium Coal Sample Program) coal samples finding that these sites exceed the amine sites. It was also shown that the presence of hydrogen bonding did not aid the incorporation of spin probes in Mary Lee (Alabama) and Black Creek (Alabama) Coal. This quarter, a study was carried out to determine whether use of ethanol as a wash solvent significantly swelled the coal during the few minutes of contact time and thus enable spin probes to be removed from encapsulating pores. The study was carried out as a function of relative spin probe size, acid/base reactive site and swelling solvent. 1 fig., 3 tabs.

12524 **(DOE/PC/90502—9) Catalyst accessibility in high volatile bituminous coal: Quarterly report.** Kispert, L.D. (Alabama Univ., University (USA). Dept. of Chemistry). Jan 1989. Contract FG22-86PC90502. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005553/JAW.

We are making use of an EPR technique developed in this lab to determine the pore size and number distribution in high volatile bituminous coal using nitroxide spin probes I-IX of different sizes, shapes, and reactivity. This year, we have studied pore size and shape distribution in Pittsburgh No. 8 (Argonne Premium Coal sample (APCS) No. 4), Blind Canyon (APCS No. 6), and Illinois No. 6 (APCS No. 3) coal from the Argonne Premium Coal Program as well as in PSOC-311 (No. 6 seam, Fruitland, New Mexico) and PSOC-1354 (Illinois No. 6, Douglas County, IL) coals. These coals were examined because independent studies related to pore size and shape distribution have recently been reported. We have also reported a study of the acidic and phenolic site distribution in Black Creek (Alabama) and APCS No. 3 coal samples finding that these sites exceed the amine site. It was also shown that the presence of hydrogen bonding did not aid the incorporation of spin probes in Mary Lee (Alabama) and Black Creek (Alabama) Coal. 5 figs., 2 tabs.

12525 **(DOE/PC/90504—T8) Configurational diffusion of coal macromolecules: Quarterly progress report, September 16, 1988--December 15, 1988.** Guin, J.A.; Curtis, C.W.; Tarrer, A.R. (Auburn Univ., AL (USA). Coal Conversion Lab.). 1988. Contract FG22-86PC90504. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005025/JAW.

Progress has been made in two areas; (1) investigation of the diffusion phenomena with alumina membranes; and (2) measurement of the diffusion coefficients of coal model compounds. In diffusion experiments with alumina membranes, the total transfer resistance from the experiments shows some degree of deviation from the estimated values. Two approaches have been made to elucidate the differences. One is introducing a tortuosity factor in the alumina membranes, and the other is developing another empirical equation for the boundary layer resistance. Second, diffusion coefficients of five polycyclic aromatic hydrocarbons were measured with Nuclepore/sup TM/ polycarbonate membranes having 0.15 μm nominal pore diameter. Diffusion coefficients calculated from experimental data show fairly good agreement with the values estimated using several estimation methods. 20 refs., 2 figs., 9 tabs.

12526 **(DOE/PC/90507—T9) Surface properties of coal and their role in coal beneficiation: Technical progress report, 15 September 1988--14 December 1988.** Fuerstenau, D.W. (California Univ., Berkeley (USA). Coll. of Engineering). Jan 1989. Contract FG22-86PC90507. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005735/JAW.

The main goal of this research is to delineate the surface properties of coal and their role in coal beneficiation. Because both bulk and surface properties are interrelated and have an effect on fine coal processing a detailed study has been undertaken to correlate bulk properties of coal particle and their wettability. The effect of oxidation on the equilibrium moisture of Cambria No. 78 and the New Zealand coals was continued. It was found that the equilibrium moisture content of the coals can be correlated with their mean critical wetting surface tension, total oxygen content and oxygen functional group concentration. Separation by film flotation and heavy liquid sink-float with centrifugation were also evaluated during this past quarter. The separation and liberation characteristics of Springfield coal using these two techniques are compared. 7 refs., 9 figs., 2 tabs.

12527 **(DOE/PC/90519—1) Electrochemical characterization and derivation of coal: Technical progress report, September 15, 1988--December 15, 1988.** Park, S.M. (New Mexico Univ., Albuquerque (USA). Dept. of Chemistry). 1988. Contract FG22-86PC90519. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005151/JAW.

Studies on the reduction of coal slurries have been initiated. The reduction of coal has been studied in a rigorously dried nonaqueous medium, N,N′-dimethyl formamide (DMF) with tetra-n-butylammonium perchlorate as a supporting electrolyte. The reduction was carried out by applying potentials identified as reducing certain functional groups on coal surfaces from preliminary cyclic voltammetric studies. The products from the electrolytic reduction were subject to the Fourier Transform Infrared (FTIR) and elemental analyses; results thereof indicate that not a significant amount of hydrogenation appears to have occurred due to this electrochemical reduction in DMF. An addition of p-benzoquinone as a reduction catalyst did not seem to change the result drastically. The addition of p-benzoquinone as a reduction catalyst does not appear to change the outcome due perhaps to the low reduction potential and also the low concentration of proton donors. During the course of this study it was discovered that adsorption plays an important role in determining the electrochemical behavior of coal slurries. We therefore carried out a preliminary, theoretical study on the effects of adsorption on the electrochemical response, when both reactant and product adsorb. 2 refs., 4 figs., 1 tab.

12528 **(DOE/PC/90521—T8) Role of porosity in supercritical fluid extraction of coal: Technical progress report.** Bale, H.D. (North Dakota Univ., Grand Forks (USA)). 15 Dec 1988. Contract FG22-86PC90521. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004758/JAW.

The primary objective of our recent work has been to clarify the role that the micropore structure plays in the fluid extraction process of coal. The study has utilized in situ small angle x-ray scattering measurements of Wyodak subbituminous coal during extraction with tetrahydrofuran (THF). 10 figs.

12529 **(DOE/PC/90529—T2) Micropore diffusion in coal chars under reactive conditions: Annual topical report, 15 September 1987--15 September 1988.** Calo, J.M.; Perkins, M.T.; Lilly, W.D. (Brown Univ., Providence, RI (USA). Div. of Engineering). 1988. Contract FG22-86PC90529. 48p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005310/JAW.

The current project is concerned with the development and application of a new technique to measure micropore diffusion under actual gasification conditions. The method is an outgrowth of and related to the transient kinetics approach to the measurement of kinetic rate parameters for char-gas reactions that has been developed in our laboratory. It can be shown that the initial transient behavior of a species introduced as a step-function into a "gradientless" reactor in which char is present, is controlled by the transport resistance offered by the char micropores. Therefore, this data can be analyzed for micropore diffusion time constants. In addition, due to the time-resolved nature of the process in the reactor, the initial diffusion step is separated (in time) from any subsequent gas-solid reaction steps. Therefore, diffusion measurements can be performed under gasification conditions. Diffusion time constant data have been obtained for a few microporous carbonaceous materials, including a Sigma (pine wood) char, a Fischer coconut char and PSOC-467 (Deadman No. 2) subbituminous coal char, in addition to the previously reported (DOE/PC/90529-Annual-1) 5A zeolite data. These data have been compared to other results, where possible, and, for the most part, they behave as expected. 65 refs., 12 figs.

12530 **(DOE/PC/90534—11) Supercritical fluid chromatography/supersonic jet spectroscopy: Progress report, June 1, 1988--November 30, 1988.** Goates, S.R.; Lee, M.L. (Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry). 1988. Contract FG22-86PC90534. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004705/JAW.

We have tested the high pressure sheath nozzle extensively, and used it successfully for capillary supercritical fluid chromatography (SFC) with supersonic jet (SJ) spectroscopy. Sensitive and selective detection of perylene and benzo[a]pyrene in a coal tar (NBS {number←sign 1597}) was achieved. Work on the pulsed direct nozzle has been less successful. As described below, one design of the nozzle has been abandoned, but another potentially promising design has emerged in its place. 2 refs., 5 figs.

12531 **(EPRI-ER—6099-SR) 1987 workshop on coal structure: Proceedings.** (Electric Power Research Inst., Palo Alto, CA (USA)). Nov 1988. 210p. (CONF-8711252—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004100/JAW.

From 1. EPRI workshop on coal structure; Monterey, CA, United States (4 Nov 1987).

The workshop featured the topics of coal liquefaction, sulfur forms in coal, and coal linkages and reactivity. Attendees at the workshop represented utilities, universities, government agencies and laboratories, private companies, and EPRI. The goal of the workshop was to guide EPRI in its future research efforts on coal structure and conversion of coal. Individual projects are processed separately for the data bases.

12532 **Sunlight photolysis of selected indoles and carbazole in aqueous coal-oil systems.** Picel, K.C.; Simmons, M.S.; Stamoudis, V.C. (Geochemistry Section, Energy and Environmental Systems Div., Argonne National Lab., Argonne, IL (US));. pp v of Photochemistry of environmental acquatic systems. Zika, R.G.; Cooper, W.J. Washington, DC; American Chemical Society (1987). (CONF-850417—).

From 189. national meeting of the American Chemical Society; Miami, FL, USA (28 Apr 1985).

Photolysis rates of indole, 2-methylindole, (2-MI), 3-MI, 5-MI, and 7-MI, which ranged from 0.038 hr/sup -1/ to 0.18 hr/sup -1/ in distilled water, were enhanced 1.3- to 5.0-fold in aqueous CRM-1 (coal-oil research material). Conversely, the rate for carbazole was 2.2-fold lower in aqueous CRM-1 than in distilled water (0.51 hr/sup -1/). Sunlight quantum yields of indoles were high (0.02-1.2), evidence that autocatalysis occurred in distilled water. In aqueous CRM-1, indoles underwent sensitized photolysis, possibly through a superoxide or singlet-oxygen intermediate. The same photoproduct of 3-MI, o-(N-formyl)aminoacetophenone, was found in both distilled water and inaqueous CRM-1. Carbazole underwent direct photolysis in both distilled water and aqueous CRM-1, indicating that it has a different photolysis mechanism from that of indoles in the two systems studied.

0108 Waste Management

REFER ALSO TO CITATION(S) 12503, 13060, 13580

12533 **(CONF-881143—2) Laboratory testing of a fluidized-bed dry-scrubbing process for the removal of acidic gases from a simulated incinerator flue gas.** Bradshaw, W.M.; Krishnan, R.P.; Young, J.M.; Mohrman, G.B. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 13p. NTIS, PC A03 - OSTI. Order Number DE89004178/JAW.

From American Institute of Chemical Engineers annual convention; Washington, DC, USA (27 Nov 1988).

A series of bench-scale tests was conducted to evaluate a dry, fluidized-bed, scrubbing process for removing acidic gases from incinerator flue gas. The acidic gases studied were sulfur dioxide, hydrogen, chloride, and phosphorous pentoxide. These gases were found to react readily with lime in a bubbling bed operating at 540 to 650{degree}C (1000 to 1200{degree}F). Superficial gas velocity, bed temperature, bed depth, sorbent type, and sorbent conversion strongly affected the degree of acidic gas removal. Sorbent utilization was inhibited by the occlusion of the particle surface by reaction products. 4 refs., 6 figs., 1 tab.

12534 **(DOE/PC/88866—T1) Flue gas conditioning for fabric filter performance improvement: Quarterly technical progress report, July--September 1988.** Miller, S.J. (North Dakota Univ., Grand Forks (USA). Energy and Mineral Research Center). 1988. Contract AC22-88PC88866. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004420/JAW.

The general objective of this project is to develop a particulate control technology that can reliably remove particulate matter, with particle diameters from 0.01 to 10 μm, from a flue gas stream with a removal efficiency of at least 99.9% for all particle sizes, independent of coal type. The method involves injection of conditioning agents into the flue gas upstream of a baghouse to increase particle collection efficiency and simultaneously reduce baghouse pressure drop. The conditioning agents, which have proven to be successful in achieving the goal of reduced fine particulate emissions in preliminary tests, are ammonia (NH_3) and sulfur trioxide (SO_3). It is the goal of the proposed research to develop this technology to the point where it is ready for field testing at the pilot level or compartment level at a full-scale utility power plant. 1 fig.

12535 **(EPRI-CS—6053) Atmospheric fluidized-bed combustion waste management design guidelines: Final report.** Lees, M.G.; Napoli, K.G.; Saylor, D.K.; Stewart, M.M. (Electric Power Research Inst., Palo Alto, CA (USA); Baker/TSA, Inc., Corapolis, PA (USA)). Dec 1988. 626p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004726/JAW.

Atmospheric Fluidized Bed Combustion (AFBC) is a commercially available and applied coal combustion technology used to control SO_2 emissions. This process is rapidly gaining utility acceptance. Because physical and chemical properties of wastes generated by fluidized bed combustors differ from those of conventional coal combustion by-products (fly ash and scrubber sludge), typical waste management practices may need to be altered. This report presents technical guidelines for designing and operating the waste management system of an AFBC facility equipped to burn coal. Waste transfer, storage, pretreatment/conditioning, transport, and disposal are addressed. These guidelines are based on current AFBC waste management practices and associated operating problems as well as critical waste properties (e.g., chemical constituents, gradation, density, moisture content, flowability, strength, leachate properties, etc.). Consequently, the report briefly describes the waste management practices of four existing or planned utility installations and four industrial facilities using bituminous coal as their primary fuel source. Results of waste property tests conducted as part of this study, and test data from other studies are reported and compared. Conceptual designs of both new and retrofit AFBC waste management systems are presented to demonstrate the economic impact of AFBC on waste management. Parametric cost sensitivity analyses illustrate the impact of significant design parameters on waste management costs. 111 refs., 81 figs., 58 tabs.

12536 **(EPRI-CS—6100) Laboratory testing of fly ash slurry: Final report.** Glogowski, P.E.; Kelly, J.M. (Electric Power Research Inst., Palo Alto, CA (USA); GAI Consultants, Inc., Monroeville, PA (USA)). Dec 1988. 472p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004487/JAW.

Over fifty million tons of coal fly ash are produced each year by coal-burning utilities in this country. While potentially useful in large-volume construction applications, such as fill, backfill, and grout, most of this material is disposed of as a waste product. One prerequisite to improved fly ash marketability is increased knowledge of its properties when used as a construction material. Numerous laboratory and field tests were performed to provide this information for fly ash-aggregate-cement slurry mixes, comparing the fly ashes themselves, various mix designs and curing conditions, and end product physical properties. This report includes results of testing performed by four laboratories. Eight Class F and four Class C fly ashes were tested. Parameters that were varied include aggregate, cement and water contents, curing condition and time, specimen size and shape, freeze-thaw cycles, and saturation. Measured properties include consistency, unconfined compressive strength, density, permeability, dimensional stability and modulus of rupture. Conclusions are presented as to relationships between test variables and the measured fly ash slurry properties. 30 figs., 11 tabs.

12537 **(EPRI-EA—5922) Leachate chemistry at the Montour fly ash test cell: Interim report.** Fruchter, J.S.; Rai, D.; Zachara, J.M.; Schmidt, R.L. (Electric Power Research Inst., Palo Alto, CA (USA); Battelle Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 90p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005537/JAW.

The Montour test-cell leachate and pore-water composition data were analyzed using an equilibrium geochemical code (MINTEQ) to compute ionic activities of different species. The different types of aqueous samples studied all show similar activity relationships for a given element for measurements made at different sampling locations in the test cell, sample depths, or times of sampling, implying that the concentration-controlling reactions are uniform throughout the test cell. The comparison of the measured activities with those calculated from equilibrium reactions involving corresponding solid phases suggest that the concentrations of Al, Ba, Ca, Cr, Cu, Fe, S, and Sr are controlled by a solubility phenomenon. The solubility-controlling solid phases of these elements used for this comparison were $Al(OH)_3(am)/Al(OH)_3(c)$, $(Ba,Sr)SO_4$, $CaSO_4/CaSO_4$ {center←dot} $2H_2O$, $Ba(S,Cr)O_4$, CuO, and $Fe(OH)_3(am)$. solid solutions appear to play an important role in controlling the concentrations of Ba, Cr, and Sr. Because of the lack of adequate fundamental data, aqueous concentrations of several trace elements (As, B, Cd, Mo, and Se) cannot currently be interpreted on a fundamental basis. The results of this study indicate that the mechanistic approach can be successful in describing and predicting chemical composition of coal ash leachates for several inorganic constituents in the field. 21 refs., 25 figs., 5 tabs.

12538 **(EPRI-GS—6155) Use of coal ash in highway construction: Michigan demonstration project.** Berry, W.H.; Gray, D.H.; Tons, E.; Stoll, U.W. (Electric Power Research Inst., Palo Alto, CA (USA); Consumers Power Co., Jackson, MI (USA); Michigan Univ., Ann Arbor (USA); Soil and Materials Engineers, Livonia, MI (USA)). Jan 1989. 53p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005742/JAW.

Mix design and compaction specifications were developed for an aggregate-free, cement-stabilized fly ash road base. The base was placed under a 1500-foot long test section of a road shoulder on either side of a four-lane, state highway in Michigan. Protocols were developed for mixing, handling and placement of the fly ash mixture in the field. A post construction monitoring and testing program was also implemented to evaluate the performance of the base course. The ash used in the project was a high carbon, Class F, dry hopper ash from a coal fired power plant. Test results showed that a cement content of 12% by dry weight of solids would be sufficient to meet strength-durability criteria and minimize frost heaving. The thickness of the fly ash-cement base was required to be ten inches after compaction and trimming. The target field density was specified at 98% of the maximum dry density based on the Modified Proctor test. The fly ash mixture was placed using a conventional travelling spreader box and compacted using both rubber tire and steel wheel rollers. 9 refs., 23 figs., 12 tabs.

12539 **(INTRON—87188) Evaluation of the results from the quality control program Balkengat obtained by 'Voorbij's Beton B.V.'.** Onstenk, E. (INTRON B.V., Maastricht (Netherlands)). Jun 1987. 9p. (In Dutch). INTRON B.V., Het Rondeel 18, 6219 PG Maastricht, Netherlands.

By order of NEOM (Dutch Energy Development Company) INTRON (Institute for Material and Environment Research) evaluated the results of the quality control executed during the filling up of the Balkengat, a former timber port in Rotterdam, with fly ash-foamed-concrete. This evaluation is part of a measurement program carried out by INTRON for fly ash-foamed-concrete. Measured data on pressure strength water absorption and some other characteristics of the fly ash application are presented and discussed. 5 tabs.

12540 **(PB—89-852230/XAB) Flue gases: detection, sampling, and analysis. January 1978-July 1986 (Citations from the NTIS data base). Report for January 1978-July 1986.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 168p. NTIS PC N01/MF N01.

See also PB—89-852248.

This bibliography contains citations concerning detection, sampling and analysis of combustion-product flue gases within the stack and at the stack exit. Detection techniques for most types of possible pollutants, such as NOX, SO_2, CO, and particulates are included. Detector design technology is also considered. (This updated bibliography contains 319 citations, none of which are new entries to the previous edition.)

12541 **(PB—89-852248/XAB) Flue gases: detection, sampling, and analysis. August 1986-November 1988 (Citations from the NTIS data base). Report for August 1986-November 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 116p. NTIS PC N01/MF N01.

Supersedes PB—86-871290. See also PB—89-852230.

This bibliography contains citations concerning detection, sampling and analysis of combustion-product flue gases within the stack and at the stack exit. Detection techniques for most types of possible pollutants, such as NOX, SO_2, CO, and particulates are included. Detector design technology is also considered. (This updated bibliography contains 166 citations, all of which are new entries to the previous edition.)

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 12503, 12507, 12537, 13573

12542 **(PB—89-130520/XAB) Improved ventilation of sealed mine Gob. Final report.** Wirch, S.D.; Berry, D.R. (Foster-Miller, Inc., Waltham, MA (USA)). Oct 1988. 22p. NTIS, PC A03/MF A01.

Abandoned underground coal mine areas must either be sealed or ventilated to comply with federal mine regulations. Ventilation of these abandoned areas is often impractical due to roof falls and inadequate primary mine ventilation. If the area is sealed, a very complex ventilation system is set up, in which the gob breathes in and out due to barometric pressure fluctuations. The Gob Assistant is a computer program (for use on IBM compatible personal computers) which allows the prediction of air flows into and out of a sealed mine area. Gas flows with applicable control techniques are also modeled. This information is presented to the user, who will decide which control technique, or combination of techniques, will ultimately be applied. The Gob Assistant is an intelligent gob simulator that can reduce the guesswork involved in predicting the effects of sealing and control techniques before they are applied. The paper provides the fundamental principles upon which the Gob Assistant is based, verification of these principles, and an explanation of how these principles were integrated into the Gob Assistant.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 12991

12543 **(PB—89-124184/XAB) Palynological studies of Middle Pennsylvanian coal beds of the proposed Pennsylvania system stratotype in West Virginia. Professional paper.** Kosanke, R.M. (Geological Survey, Alexandria, VA (USA)). 1988. 87p. (PP—1455). NTIS, PC A05/MF A01.

Also available from Supt. of Docs. Library of Congress catalog card no. 86-600336.

Forty-one different sets of coal samples and adjacent strata of the Kanawha Formation, including 153 individual samples, were prepared and examined in detail and 16 additional sets of coal samples and adjacent strata from the Charleston Sandstone, including 37 individual samples, were prepared and examined in detail. Species of the genus Lycospora dominate the palynomorph assemblages throughout much of the Kanawha Formation. Exceptions to this dominance are sporadic abundances of Densosporites, Endosporites and Radiizonates. Laevigatosporites by itself and combined with Torispora in the lower part of the Charleston Sandstone dominates these palynomorph assemblages. Some paleobotanical evidence suggests that species of Densosporites, Endosporites, and Radiizonates are related to herbaceous plants. Periodically throughout the Kanawha Formation these taxa dominate palynomorph assemblages of some of the coal beds. This may suggest herbaceous plants replace arborescent swamp plants as the primary contributor to these coal beds.

12544 **(PB—89-124242/XAB) Geology and resource appraisal of the Felix coal deposits, Powder River Basin, Wyoming: a research project with the People's Republic of China.** Kent, B.H.; Weaver, J.N.; Roberts, S.B.; Ming, T.; Shu, L. (Geological Survey, Alexandria, VA (USA)). 1988. 41p. (USGS-BULL—1818). NTIS, PC A03/MF A01.

Also available from Supt. of Docs. Library of Congress catalog card no. 87-600376.

The Felix coal bed in Eocene age rocks crops out on the eastern flank of the Powder River basin in northeastern Wyoming, where the outcrop trace of the Felix encompasses an area of 2,500 sq mi. To facilitate area resource assessment at a 1:100,000 scale, 'deposit' was defined as the principal resource unit of Felix coal. The deposit contains a total of 32 billion tons of subbituminous coal, and the central core of combined coal comprises 4.6 billion tons of that total. The Felix coal deposit is also a regional geologic feature. During early Eocene time, basin subsidence and eastern uplifts interacted to establish and prolong optimal environments and conditions for (Felix) coal deposition and maintain a dynamic balance between subsidence and peat accumulation. The nature of such interactions is best described by a 'teeter-board' analogy: if an area is subsiding while an opposing area is uplifted, an intervening fulcrum area is in dynamic equilibrium.

12545 **Overlapping grain models for gas-solid reactions with solid product.** Sotirchos, S.V.; Yu, H.C. (Univ. of Rochester, Rochester, NY (US)); *Industrial and Engineering Chemistry Research;* **27**: No. 5, 836-844(May 1988).

General overlapping grain models were developed for gas-solid reactions with solid product. The development of the models was based on the assumption that the pore and reaction surfaces of the reacting solid may be represented by two populations of overlapping grains which share the same centers (spherical grains), axes (cylindrical grains), or planes (platelike grains) of symmetry. Specific model equations were formulated for randomly overlapping grains and applied to the sulfation of calcined limestone. The results obtained revealed strong dependence of the overall reactivity of the porous solid on grain overlapping and the type of the grain size distribution. Comparison of the results with the predictions of random pore models showed that capillary structures exhibit, in general, higher reactivities than grainy ones.

0120 Mining

REFER ALSO TO CITATION(S) 13573

12546 **(DOE/EIA—0125(88/3Q)) Coal distribution, January--September 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 11 Jan 1989. 125p. NTIS, PC A06/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89006027/JAW.

From January through September 1988, coal production and distribution totaled all-time record highs for the first three quarters of the year. This was in response to strong demand from both domestic and foreign coal users. Highlights of the data for the first three quarters of 1988 include that coal production totaled 705 million short tons, nearly 5 percent above the level a year earlier; coal stocks held by producers and distributors on September 30, 1988, were 31 million short tons, 3 million short tons above the level they started the year at; total coal shipments were 28 million short tons higher than the level a year earlier (this was composed of 15 million short tons in additional domestic coal shipments and 13 million short tons in additional foreign coal shipments); and the share of coal shipped by railroads for domestic use reached 57.5 percent compared to 56.9 percent for the same three quarters of 1987.

12547 **(IOM-TM—88-11) Investigations of the feasibility of using aerodynamic models for studying the local build-up of methane gas and risk of frictional ignition in mines.** Aitken, R.J.; Vincent, J.H.; Mark, D.; Botham, R.A. (Institute of Occupational Medicine, Edinburgh (UK)). Aug 1988. 72p. Institute of Occupational Medicine, Edinburgh (UK).

The project examined the extent to which it is possible from small-scale model studies in the laboratory to obtain realistic indices relevant to the potential local accumulation of methane gas in coal mines. Of particular interest were locations where methane may be relased but where ventilation may be relatively inefficient; for example, on the longwall coalface in the cutting zone (in the lee of the winning machine) and in headings. In these regions, the flow is partially enclosed so that ventilation is substantially influenced by turbulent mixing with the main ventilation airstream. The aim was to carry out experiments to investigate how the appropriate indices of ventilation effectiveness scale between models in the laboratory (using 'systematic' models of longwall coalfaces at approximately 1/

10-scale) and full-scale models of the surface and at actual underground locations. It was found that for the bulk airflow along the coalface, scaling can be achieved for systems from 1/10-scale up to full-scale, provided that the mean air velocity exceeds 2 m/s; for the flow in the lee of the cut, direct scaling applies if the value of Reynolds number ((Re) for the cut) exceeds 50,000; and for non-ventilated headings, direct scaling applies for all practical values of Re (for the heading) for systems from 1/10-scale up to full-scale.

12548 **(PB—89-127617/XAB) Development of Face Decision Support System for underground coal mines. Research report, May 1985-August 1988 (Final).** Nutter, R.S.; Reddy, Y.V.; Grayson, R.L.; Klishis, M. (West Virginia Univ., Morgantown (USA)). 15 Aug 1988. 209p. NTIS, PC A10/MF A01.

An expert-system advisor consultant to assist a coal-mine section foreman is described in the report. The system is designed for an underground continuous-miner section specifically used for longwall development. The system provides three methods of operation that include normal operational mode for use underground, a training mode for use in training section foremen under controlled classroom conditions, and a demonstration mode that is free running. The Face Decision Support System or FDSS, is designed to interface with section environmental-monitoring equipment and section production-monitoring equipment that may appear in the future. This provides automated reprioritization of the section foreman's job list from the system. The system is written in LASER which is written in C and is operated under the UNIX operating system. The objective of the entire FDSS system is to ensure that no job or piece of information important to safety or to production is forgotten because of the immediate problems confronting the section foreman.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 12515, 12546

12549 **(CONF-8809194—2) Optical instrumentation and study of gas-solid suspension flows.** Ling, S.C.; Pao, H.P. (Catholic Univ. of America, Washington, DC). 1988. Contract FG22-86PC90956. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005137/JAW.

From Solids transport contractor review meeting; Pittsburgh, PA, USA (1 Sep 1988).

The study of gas-solid suspension flow is being conducted in two parts; the lifting of heavy particles from the flow boundary by micro-hairpin vortices and the design of an optical instrument to investigate the characteristic of turbulent flows and particle-size concentrations. The study of micro-hairpin vortices is based on the observation of these vortices in a cavitation water-tunnel. The micro-vortices exist within the laminar and intermediate sublayer of the turbulent flow field where the velocity gradient is most intense. These vortices are believed to be the major production source of turbulence which also are responsible for the picking up of heavy solid particles from the flow boundary. However, this important transport mechanism near the boundary was not taken into account in all previous theories of solid transport. It is hoped that this work will provide a more basic understanding on the mechanics of solid transport. Our major research effort for the year is concentrated on the construction of the experimental test-setup and the development of an optical particle-size and concentration detector. The optical detector also provides the information of flow characteristics. A comprehensive description of the instrumentation technique will be presented. 4 refs., 2 figs.

12550 **(DOE/PC/80524—T11) Pipe and bend erosion by pneumatic transport of solids at high temperature: Quarterly report, January--March 1988.** Klinzing, G.E. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). 1988. Contract FG22-85PC80524. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006090/JAW.

A general approach to the study of bend erosion was developed, in which wedge sample experiments and computer modelling were integrated to generate the erosion pattern in circular bends. Sand was used as the erodent material.

12551 **(DOE/PC/90518—T6) Aerated and vibrated chute feeders for particulate materials: Quarterly technical report, September 1, 1988--November 30, 1988.** Jackson, R.; Nott, P.R. (Princeton Univ., NJ (USA). Dept. of Chemical Engineering). 1988. Contract FG22-86PC90518. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005375/JAW.

We have been studying the problem of aerated flow of particulate materials down inclined chutes as part of our effort to gain a better understanding of the mechanics of granular flows. We have laid down the theoretical framework for the analysis of these problems and have solved the equations of motion for the case of aerated flow in inclined chutes. We are now in the process of setting up our experimental apparatus so that we can make measurements of the relevant flow variables. 8 refs.

0140 Combustion

REFER ALSO TO CITATION(S) 12503, 12535, 13361

12552 **(CONF-881091—1) Ideal combustion of solid fuels.** Ling, S.C.; Pao, H.P. (Catholic Univ. of America, Washington, DC). 1988. Contract FG22-86PC90956. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005136/JAW.

From Coal: fuel for today and for the future; Pittsburgh, PA, USA (4 Oct 1988).

Unlike the unstable, runaway, combustion of micro-fuel particles, solid fuel in the reconstituted form of a specifically shaped charge was found to have stable and ideal combustion characteristics suitable for the automatic control of combustion rate and temperature. Consequently, most environmental and operational problems associated with the atomized-combustion process can be eliminated. The shaped-charge fuel is applicable for both large power generation as well as for small home heating. 1 ref., 3 figs.

12553 **(DOE/METC—88/4083) High resolution capacitance imaging system: Technical note.** Fashching, G.E.; Smith, N.S. (USDOE Morgantown Energy Technology Center, WV). Sep 1988. 44p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE88010277/JAW.

The US Department of Energy's Morgantown Energy Technology Center (METC) has been developing instrumentation for improved monitoring of fluidized-bed operational parameters. This report describes the electronic system being developed to provide a real-time two-dimensional map of the bed material density with a resolution of 1 inch or better and with a map update rate of about 100 updates per second. This two-dimensional system is the major step in the development of the desired three-dimensional density mapping system. The density monitoring system uses a 6-inch inside diameter (ID) by 2-feet long plastic pipe as the fluidized-bed vessel. At a point halfway between the ends of the pipe, 16 1-inch x 1-inch metal electrodes are mounted on the inner surface of the pipe. With the pipe in a vertical position and holding 1/8-inch plastic spheres, air can be introduced at the bottom of the pipe to fluidize the spheres. By measuring the displacement currents between electrodes, equations relating the measured currents to bed density values are formed. Solving the equations produces the density values at 49 designated areas covering the bed cross section. Preliminary tests of the system have shown that single bubbles passing through the monitored bed cross section can be seen crossing the monitored region and can be located at n particular positions at times t_1, t_2, ..., t/sub n/ by solving the developed equations using the electrode displacement current values at times t_1, t_2, ..., t/sub n/ . Further development is necessary to refine the computation of density values at each of the 49 designated areas and to extend the system's capability to three-dimensional, real-time bed density mapping. 5 refs., 13 figs., 7 tabs.

12554 **(DOE/METC—89/4087) A study of alkali partitioning in a bench-scale, pressurized combustor fired with a coal-water mixture: Technical note.** Mallin, J.R.; Logan, R.G.; Wachter, J.K.; Nakaishi, C.V. (USDOE Morgantown Energy Technology Center, WV). Nov 1988. 44p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000904/JAW.

Two natural gas-fired and six coal-water mixture- (CWM) fired experiments were conducted with the bench-scale pressurized combustor (BSPC) at the Morgantown Energy Technology Center (METC). Two CWMs were prepared by AMAX from a Kentucky Hazard bituminous coal. One fuel was prepared from a physically cleaned coal and contained 2.4 percent ash on an as-fired basis. The second CWM was prepared from a coal that underwent both physical and chemical cleaning which reduced the ash content to 0.4 percent. The tests were designed to examine the partitioning of sodium and potassium between vapor and non-vapor products of combustion in the exhaust stream, and the distribution of total alkali between bottom ash and uncharacterized residual matter (including slag). Two on-line alkali monitors developed at METC were used to measure both the gaseous alkali and total alkali concentrations in the exhaust from the combustor. We found the proportion of alkali exiting the combustor in the vapor phase was small. Less than 1 percent of sodium and less than 5 percent of potassium that entered as part of the fuel left the combustor as a vapor. Most of the alkali leaving the combustor was associated with particle matter. On a per pound basis, burning the highly cleaned, low-ash CWM produced more alkali in the exhaust stream than burning the less processed, high-ash CWM. The additional cost of preparing the highly cleaned fuel yielded no benefit in terms of alkali reduction in the exhaust. The researchers recommend that investigations in the area of alkali reduction be directed toward removing the particles with which the majority of the alkali in the exhaust is associated. 15 refs., 8 figs., 13 tabs.

12555 **(DOE/PC/79901—T3) Radiative properties of ash and slag: Fifth quarterly report, August 1, 1988--October 31, 1988.** Solomon, P.R.; Markham, J.R. (Advanced Fuel Research, Inc., East Hartford, CT (USA)). 1988. Contract AC22-87PC79901. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005568/JAW.

Thermal radiation plays a key role in the operation and efficiency of combustion systems, accounting for over 90% of the heat transfer. The analysis of radiative heat transfer in coal-fired boilers, combustion chambers and other energy systems requires accounting for the effects of inorganic deposits on bonding surfaces and of entrained particulates, such as pulverized coal, char and fly-ash. These effects can be predicted; however, the accuracy in predicting the radiative properties of entrained particles (ash) and deposit layers (slag) is limited by inaccurate knowledge of the physical/chemical properties of the materials over a range of material temperatures and radiative wavelengths that is representative of conditions in practical combustion systems. The objective of this project is to make laboratory measurements of the radiative properties of extracted ash deposit samples. During this quarter, a presentation and paper were prepared for the AR and TD Direct Utilization Contractors Review Meeting. The Project Implementation Plan was reviewed and approved at the meeting. Work has then initiated on the design and construction of the combustion-heated wall-less reactor and the rotating optical table that, when coupled to a Fourier Transform Infrared (FT-IR) spectrometer, will allow for the high temperature radiative properties measurements. Also, room temperature infrared extinction measurements were performed on three fly ash samples that were collected from large scale combustion facilities. This information will be used for validation of our determination of optical constants that are part of a sample's complex index of refraction. 4 figs., 1 tab.

12556 **(DOE/PC/79909—4) Pyrite thermochemistry, ash agglomeration, and char fragmentation during pulverized coal combustion: Quarterly report, June 15, 1988--September 15, 1988.** Akan-Etuk, A.; Niksa, S.; Kruger, C.H. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). Oct 1988. Contract FG22-87PC79909. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005380/JAW.

We perfected the synthesis of carbons with controlled macroporosity and pyrite loadings. Lycopodium spores were found to be ideal formers of macroporosity, being monodisperse, spherical, and nontoxic. They are added as a powder during the furfuryl alcohol polymerization, so the number density of voids is easily controlled. They are almost completely volatilized during curing, and leave no ash or residue. Our procedure generates nominally uniform, 16 micron spherical voids in a microporous carbon matrix. Pyrite inclusions are generated by adding sized pyrite particles during the furfuryl alcohol polymerization. However, the pyrite loading was found to be difficult to control. Due to its high density, the pyrite tends to settle throughout the synthesis. We must rely on ultracentrifugation using a range of liquids with controlled specific gravity to segregate samples with controlled pyrite loadings. 3 figs.

12557 **(DOE/PC/80261—T11) Slagging retrofit pulsed coal combustor: Final report.** (Avco-Everett Research Lab., Everett, MA (USA)). [1987]. Contract AC22-85PC80261. 95p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005810/JAW.

A concept for a novel form of slagging retrofit pulsed coal combustor was tested in the laboratory. The combustor is based on controlled use of a form of high pressure amplitude combustion instability. The approach adopted was to resolve, in single pulse experiments, the basic technical issues arising in the development of the combustor. In a cold flow device, the issues of coal spatial distribution were addressed and a combustor and solids disperser configuration was developed to give uniform coal distribution in the combustor. Single pulse ignition experiments were conducted to determine the pressure rise in combustor, pressure rise-decay times, and coal conversion a function of various operating variables. Coal injection, flame propagation, and blowdown times leading to potential combustor size reduction of three times over steady flow combustors were demonstrated. The results give high pressure exhaust leading to potentially improved downstream heat transfer and reduced boiler size. Finally, zero-, one-, and two-dimensional mathematical models were developed in support of the experiments and also to provide design capability. 11 refs., 43 figs.

12558 **(DOE/PC/80511—T15) Hydrodynamics, mixing, and segregation in gas fluidized beds: Progress report, 22 July 1988--21 October 1988.** Chen, M.M.; Chao, B.T. (Illinois Univ., Urbana (USA). Dept. of Mechanical and Industrial Engineering). 1988. Contract FG22-85PC80511. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004742/JAW.

Efforts during this period have been focussed on the study of particulate stresses in the fluidized bed and the analysis of the dynamic nature of the densed gas-solid suspension systems. 4 refs., 4 figs.

12559 **(DOE/PC/80752—T14) Detailed model for practical pulverized coal furnaces and gasifiers: Quarterly technical progress report No. 11 for the period August 1, 1988 to October 31, 1988: Fourteenth quarterly report period.** Smith, P.J.; Smoot, L.D. (Brigham Young Univ., Provo, UT (USA). Combustion Lab.). 30 Nov 1988. Contract FG22-85PC80752. 23p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005356/JAW.

On May 1, 1985, work was initiated on a contract sponsored by a consortium of industrial and governmental agencies aimed at development of a practical, 3-D coal combustion model. The general objective of this study is to improve and extend a generalized two-dimensional, pulverized coal combustion and gasification code for application to large-scale, practical configurations, and to evaluate and implement the resulting code on an industrial scale. This report summarizes work conducted during the second quarter of the fourth year (fourteenth quarter) of this contract. A summary of work accomplished during this quarter is given by task, only 3-D model development work was performed. 6 refs., 6 figs., 2 tabs.

12560 **(DOE/PC/90505—T4) Mechanism of surface enrichment and adhesion of coal combustion particulates: Fifth quarterly report.** Shadman, F.; Peterson, T.W.; Wendt, J.O.L.; Rizeq, R.G. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). Dec 1988. Contract FG22-86PC90505. 37p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004998/JAW.

In this phase of the project, the effect of alkali surface concentration on the agglomeration of particles of potential additive particles is studied. A technique for characterization of surface concentration using Scanning Auger Microprobe (SAM) is applied. An agglomeration (adhesion) temperature is defined which characterizes the adhesion propensity of particles. An experimental technique is developed to measure this agglomeration point point in situ without sample quenching or removal. The effect of alkali adsorption on the agglomeration characteristics of the substrates is determined. The agglomeration temperature for all substrates decreases as alkali content increases. At low loadings the alkali adsorption enhances particle agglomeration by forming new compounds of lower melting points. At high concentrations, the agglomeration point of all substrates approaches the melting point of condensing alkali. Under these conditions, adhesion and agglomeration are caused by a layer of molten alkali which covers the exterior of the particles. 5 refs., 9 figs., 16 tabs.

12561 **(DOE/PC/90753—T10) Coal ash deposition, interaction with metal substrates and deposit build up: Tenth quarterly report, September 24, 1988--November 25, 1988.** Birks, N. (Pittsburgh Univ., PA (USA). Dept. of Materials Science and Engineering). 1988. Contract FG22-86PC90753. 24p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004834/JAW.

The objective of this program is to characterize the attack of the metal substrate (stainless steel 304) subsequent to the deposition of ash and incompletely transformed ash minerals under oxidation/sulfidation environments and a high temperature. In the absence of authoritive knowledge concerning the transformation route by which a coal mineral reacts to become an oxide constitutent of the ash, it was decided to represent the ash or partly converted minerals using appropriate ternary systems based on potassium, sodium, calcium, silicon and magnesium oxides in which low melting eutectics are formed, referred to in this work as "slags". Untransformed or incompletely transformed minerals can also act as a direct source of sulfur and as a direct cause of transient liquid formation when placed on metal substrates under an oxidation/sulfidation environment. In this way, it is intended to simulate the initial deposition of ash, oxide formation on the metal, bonding between ash and substrate, liquid layer formation and corrosive attack of the underlying metal surface. 16 figs.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 12515, 12546, 12987

0160 Health And Safety

REFER ALSO TO CITATION(S) 12548

02 PETROLEUM

0201 Reserves

12562 **(DOE/EIA—0370(88)) Oil and gas field code master list 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 1988. 671p. NTIS, PC A99 - GPO - OSTI. Order Number DE89006044/JAW.

The {ital Oil and Gas Field Code Master List 1988} is the seventh annual listing of all identified oil and gas fields in the United States. It is updated with field information collected through October 1988. The purpose of the publication is to provide codes for easy identification of domestic fields. Standardization on these field codes will foster consistency of field identification by government and industry. 9 figs., 4 tabs.

12563 **(SAND—88-1895) Microwave transmission through strategic petroleum reserve crude oil samples from Bayou Choctaw [BC] caverns.** Castle, J.G. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 39p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006364/JAW.

Transmission of microwave power at frequencies from 1 to 11 GHz has been observed through a short, slotted, coaxial line filled with crude oil from each of five wellhead samples collected at Bayou Choctaw (BC) and one sample from a West Hackberry cavern (WH105). An accurate model for the filled slotted line is used to derive the dielectric constant and loss tangent for each oil. The highest loss occurs in oil from BC19 whose loss tangent is 0.0103 at 1 GHz; the lowest, in WH105 whose loss tangent at 1 GHz is 0.0026. These data suggest favorable prospects for high-resolution radar mapping of SPR cavern walls. Sulphur compounds in the oil appear to be the major source of the microwave attenuation. 20 refs., 4 tabs.

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 12578

12564 **(NIPER—286) Verification of geological/engineering model in waterflood areas.** Sharma, B.; Szpakiewicz, M.; Honarpour, M.; Schatzinger, R.A.; Tillman, R. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Dec 1988. Contract FC22-83FE60149. 61p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000710/JAW.

The construction of a detailed geological/engineering model is the basis for development of the methodology for characterizing reservoir heterogeneity. The NIPER geological/engineering model is the subject of this report. The area selected for geological and production performance studies is a four-section area within the Powder River Basin which includes the Tertiary Incentive Project (TIP) pilot. Log, well test, production, and core data were acquired for construction of the geological model of a barrier island reservoir. In this investigation, emphasis was on the synthesis and quantification of the abundant geological information acquired from the literature and field studies (subsurface and outcrop) by mapping the geological heterogeneities that influence fluid flow. The geological model was verified by comparing it with the exceptionally complete production data available for Bell Creek field. This integration of new and existing information from various geological, geophysical, and engineering disciplines has enabled better definition of the heterogeneities that influence production during different recovery operations. 16 refs., 26 figs., 6 tabs.

12565 **(UCID—21303-88-4) Petroleum geochemistry project: Annual report, October 1987--September 1988.** Braun, R.L.; Burnham, A.K.; Sweeney, J.J. (Lawrence Livermore National Lab., CA (USA)). Dec 1988. Contract W-7405-ENG-48. 69p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006014/JAW.

The objective of this work is to develop and test chemical kinetic models of oil generation and expulsion to aid oil exploration. The work has several compounds: experiments to understand the mechanisms and kinetics of oil generation, development of computer programs for analyzing experiments and applying chemical kinetics in a geological environment, and comparing predictions of chemical/geological models to field data. Numerous Rock Eval and oil generation experiments were carried out on several different petroleum source rocks. Our principal computer programs (KINETICS, PYROL, and BASINMAT) were further developed and applied to laboratory and/or geologic conditions. PYROL now uses a modified Redlich-Kwong-Soave equation of state and calculates expulsion of vapor and liquid products as well as compaction and fracture of the source rocks. Some aspects of this work are part of a joint research project with INTEVEP, S.A., in which model predictions will be tested in the Maracaibo Basin. Other aspects are being done with partial support from an industrial sponsorship program that began this year. 28 refs., 32 figs., 13 tabs.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 13703

12566 (DOE/BC—89/1/SP) Fourth amendment and extension to Annex IV, enhanced oil recovery thermal processes. Reid, T.B.; Rivas, O. (USDOE Bartlesville Project Office, OK; INTEVEP, Filial de Petroleos de Venezuela, SA, Caracas). Nov 1988. 167p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000702/JAW.

This report contains the results of efforts under the six tasks of the Fourth Amendment and Extension of Annex IV, Enhanced Oil Recovery Thermal Processes of the Venezuela/USA Agreement. The report is presented in sections (for each of the 6 tasks) and each section contains one or more reports prepared by various individuals or groups describing the results of efforts under each of the tasks. A statement of each task, taken from the agreement, is presented on the first page of each section. The tasks are numbered 32 through 37. Tasks are: thermal front tracking tests; INTEVEP electromagnetic and seismic studies; INTEVEP steam-foam research; DOE-Stanford University Petroleum Research Institute steam additive and modelling research; INTEVEP steam additive field test; and DOE-NIPER light oil steamflooding research. Individual projects are processed separately for the data bases.

12567 (DOE/BC/10830—9) An evaluation of the Big Muddy Field low-tension flood demonstration project. Cole, E.L. (K and A Technology, Tulsa, OK (USA)). Dec 1988. Contract AC19-85BC10830. 158p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000713/JAW.

A commercial scale low-tension flood (micellar-polymer) demonstration project was conducted in the Second Wall Creek Reservoir in the Big Muddy Field in east central Wyoming. The cost-shared, low-tension flood used a 0.1 pore volume preflush and a 0.1 pore volume low-tension slug followed by a polymer drive bank. The sulfonate used in the low-tension slug was a blend of both low and high molecular weight synthetic sulfonates. Dow Pusher 500, a dry polyacrylamide polymer, was used in both the low-tension slug and polymer drive bank for mobility control. Although project oil recovery was or will be significantly less than originally predicted, the low-tension process successfully mobilized waterflood residual oil. The primary factor contributing to lower than anticipated recovery was lack of containment of the injected fluids in the reservoir. Behind-pipe communication in abandoned or reconditioned wellbores in the project area represented the most probable source of fluid migration from the reservoir. Fluid entry from other reservoirs occurred concurrently with migration of the fluids from the reservoir. Fluid containment deteriorated significantly when injection pressures during the polymer injection period were allowed to exceed the formation parting pressure. Injectivity in the relatively low permeability reservoir was a continuing operational problem. 6 refs., 78 figs., 19 tabs.

12568 (DOE/BC/10830—10) An evaluation of the Robinson M-1 commercial scale demonstration of enhanced oil recovery by micellar-polymer flood. Cole, E.L. (K and A Technology, Tulsa, OK (USA)). Dec 1988. Contract AC19-85BC10830. 135p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000714/JAW.

A commercial scale micellar-polymer project was conducted in the Robinson Sand of the M-1 project in southwestern Illinois. The project utilized a crude oil sulfonate surfactant system to flood the reservoir which, at the time of the project, was in an advanced stage of waterflood depletion. Injected fluids consisted of a 0.10 pore volume crude oil sulfonate slug, a 1.05 pore volume graded mobility slug using Dow Pusher 700, and a drive water slug to depletion. Micellar injection started in 1977. By December, 1986, overall operations in the 2.5-acre pattern area were uneconomical while polymer injection was continuing in the 5.0-acre pattern area. Depletion of the 5.0-acre pattern area is forecast for 1991 or sooner. Ultimate oil recovery is estimated at 1,397,000 barrels with cumulative oil recovery at December, 1986, of 1,299,000 barrels. Although the crude oil sulfonate system successfully mobilized and produced waterflood residual oil, the project was not economic because of both lower than anticipated recovery and higher than expected operating costs. The lower than anticipated recovery is attributed to poor volumetric sweep efficiency and salinity/hardness effects. 7 refs., 54 figs., 25 tabs.

12569 (DOE/BC/10841—10) Modeling and optimizing surfactant structure to improve oil recovery by chemical flooding at the University of Texas: Annual report for the period October 1986--September 1987. Schechter, R.S.; Falk, N.; Lam, A.; Leazer, N.; Sparling, L.; McGreevy, R.; Middleton, M.; de Rozieres, J. (Texas Univ., Austin (USA). Dept. of Petroleum Engineering). Dec 1988. Contract AC19-85BC10841. 72p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000712/JAW.

The objectives of this research program are (1) to characterize mineral oxide surfaces and to relate these parameters to surfactant adsorption, (2) to study chromatographic effects resulting from use of surfactant blends, (3) to understand the properties of microemulsions as they relate to surfactant structure, and (4) to develop a thermodynamic theory of microemulsions which includes surfactant structure, cosolvents, and surfactant blends as well as the properties of the system oil and water. 35 refs., 26 figs.

12570 (DOE/BC/10846—10) Modelling and scale-up of chemical flooding: Second annual report for the period October 1986--September 1987. Pope, G.A.; Lake, L.W.; Sepehrnoori, K. (Texas Univ., Austin (USA). Dept. of Petroleum Engineering). Nov 1988. Contract AC19-85BC10846. 347p. NTIS, PC A15/MF A01 - OSTI; 1; GPO Dep. Order Number DE88001251/JAW.

The objective of this research is to develop, validate, and apply a comprehensive chemical flooding simulator for chemical recovery processes involving surfactants, polymers, and alkaline chemicals in various combinations. This integrated program includes components of laboratory experiments, physical property modelling, scale-up theory, and numerical analysis as necessary and integral components of the simulation activity. Developing, testing and applying flooding simulator (UTCHEM) to a wide variety of laboratory and reservoir problems involving tracers, polymers, polymer gels, surfactants, and alkaline agent has been continued. Improvements in both the physical-chemical and numerical aspects of UTCHEM have been made which enhance its versatility, accuracy and speed. Supporting experimental studies during the past year include relative permeability and trapping of microemulsion, tracer flow studies oil recovery in cores using alcohol free surfactant slugs, and microemulsion viscosity measurements. These have enabled model improvement simulator testing. Another code called PROPACK has also been developed which is used as a preprocessor for UTCHEM. Specifically, it is used to evaluate input to UTCHEM by computing and plotting key physical properties such as phase behavior interfacial tension.

12571 (DOE/BC/14084—6) Microbial field pilot study: Final report, December 15, 1986--March 31, 1988. Knapp, R.M.; McInerney, M.J.; Menzie, D.E.; Raiders, R.A. (Oklahoma Univ., Norman (USA). Dept. of Botany and Microbiology). Jan 1989. Contract FG19-87BC14084. 104p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000721/JAW.

The field pilot project is designed to test several hypotheses: the ability of indigenous populations of microorganisms to selectively plug oil-bearing sandstone and divert flow on a field scale, the ability of this plugging process to liberate additional oil beyond that recovered during waterflood, and the control of sulfate-reducing bacteria by nitrate addition. To facilitate this testing, we have planned the pilot project by studying the ecology of the reservoir environment, characterizing the field and the operating history, and testing selective plugging in laboratory core experiments. The produced connate water was found to contain low concentrations of a diverse population of microorganisms which live in 12% to 19% NaCl salt. Several species were isolated which could utilize molasses as a carbon source and nitrate. Sulfate reducing bacteria were also isolated, and the control of sulfate reduction by nitrate addition was observed. The BOAST reservoir simulation model program was used to perform a history match on the SEVVSU. The characterization study included a comprehensive geological study to identify significant reservoir parameters and reinterpretation of available

geological and production data. A model has been developed that will assist in interpreting pilot performance data.

12572 (DOE/MC/12004—6) Weeks Island gravity stable CO_2 pilot: Final report. Johnston, J.R.; Perry, G.E. (Shell Offshore, Inc., New Orleans, LA (USA)). Jan 1989. Contract AC05-77ET12004. 84p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000719/JAW.

The Weeks Island "S" sand Reservoir B ("S" RB) gravity-stable CO_2 field test was completed during February 1988. Injection started in October 1978 and production began in January 1981 in this high-permeability, steeply-dipping sandstone reservoir. About 264,000 barrels of oil or 65 percent of the starting volume has been recovered. A 24-percent pore-volume slug of CO_2 mixed with about six mole percent of natural gas (mostly methane) was injected at the start of the pilot. Since 1983, produced CO_2 plus hydrocarbon gases have been recycled. CO_2 usage statistics are 9.34 MCF/BO with recycle and 3.24 MCF/BO based on purchased CO_2. Previous annual reports document the pilot design, implementation, and early results for the 1977 to June 1981 time period. This report is a review of early pilot history and a more detailed account of the post June 1981 results and overall interpretation. A reservoir-simulation history match of pilot performance plus core and log data from a 1983 swept-zone evaluation well are described in this report. A brief description of the production facility and an account of the corrosion control program are also included. 11 refs., 34 figs.

12573 (DOE/MC/21136—17) Improvement of CO_2 flood performance: Third annual report, October 1, 1986--September 30, 1987. Heller, J.P.; Kovarik, F.S.; Taber, J.J. (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center). Jan 1989. Contract FC21-84MC21136. 233p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000720/JAW.

This report provides results obtained for the third year of a three-year, comprehensive, cost-shared, applied research program designed to improve oil recovery through carbon dioxide (CO_2) flooding. The program was composed of three areas: Task 1{endash}Phase Behavior and Fluid Property Measurements, Task 2{endash}Mixing of CO_2 and Oil During Flow in Reservoir Rocks, and Task 3{endash}Mobility Control in CO_2 Floods. In Task 1, the continuous phase equilibrium apparatus was used to measure simultaneously the viscosity, density, and composition of CO_2-hydrocarbon systems at high pressure. In Task 2, the performances of secondary and tertiary displacements of crude oil by CO_2 in cores were measured and compared to predictions made with a multicomponent, one-dimensional simulator. In Task 3, procedures and equipment were developed to measure the steady-state mobility of foam-like dispersions of dense CO_2 in surfactant solutions. 72 refs., 116 figs., 31 tabs.

12574 (DOE/SF/11999—2) Chemical additives for improving steamflood performance: Final report, January 1, 1984--May 31, 1987. Handy, L.L. (University of Southern California, Los Angeles (USA). Dept. of Petroleum Engineering). Jan 1989. Contract AS03-84SF11999. 115p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000722/JAW.

Relative oil and water permeabilities have been measured experimentally as functions of both temperature and interfacial tension. The effect of temperature appears to shift the curves in the direction of more water wet systems. Reducing interfacial tension or increasing the capillary number above about 10^{-3} moves the curves in the direction towards a direct proportionality between the relative permeability of the specific phase and its corresponding saturation, which might be predicted for totally miscible fluids. Correlations have been developed which permit the application of these data in the simulator model. Questions are discussed with respect to the use of the capillary number and the residual wetting phase saturation in the correlations for the wetting phase. Studies have continued on the mechanism of foam flow. Of particular interest are open tap pressure measurements in the presence of foam which suggest that the gas in the foam is semi-continuous with a pressure greater than the liquid by an amount about equal to the capillary entry pressure. This suggests, but does not prove, that the bubble concept of flow for foams is not the correct one.

12575 (NIPER—237) Screening of cosurfactant-free slugs: Project BE4A, milestone 12, FY87: Topical report. Olsen, D.K. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Mar 1988. Contract FC22-83FE60149. 27p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004076/JAW.

This report describes our initial work with amine oxides as surfactants for chemical flooding. Our work on carboxymethylated ethoxylates was previously reported in NIPER-228. Amine oxides have high salinity range, yield low interfacial tensions, have high solubilization parameters, and, at the same time, increase the viscosity of the surfactant slug without the addition of polymer, and thus avoiding problems caused by surfactant - polymer interactions. The oil displacement results reported incorporate alcohol as a cosurfactant in the amine oxide formulations, however, compounds that attempt to incorporate the cosolvent moiety into the amine oxide molecule (ethoxylated or propoxylated amine oxides) are being studied at NIPER. 60 refs., 4 tabs.

12576 (NIPER—340) Mineral-alkali reactions under dynamic conditions: Topical report. Thornton, S.D.; Lorenz, P.B. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Nov 1988. Contract FC22-83FE60149. 25p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE88001253/JAW.

Three alkaline agents---sodium orthosilicate, sodium carbonate, and sodium bicarbonate---were injected into slim tubes packed with Wilmington (CA) sand containing synthetic Wilmington brine and Wilmington crude oil at waterflood residual saturation, and reservoir temperature, 52{degree}C. The effluent solutions during 3 pore volumes of chemical injection and 1 pore volume of water drive were analyzed for calcium, magnesium, sulfate, total alkalinity, and pH. The transmission of all components was delayed, but to different degrees. Some of the results were interpreted in terms of solubilities of calcium and magnesium silicates and carbonates, and calcium sulfate. Known ionic equilibria were used to interpret the pH history for bicarbonate injection, and indicated a loss of carbon dioxide from the samples before analysis. The orthosilicate gave the best tertiary oil recovery, but bicarbonate was transmitted with much less loss, and showed promise of being a cost-effective agent when enhanced with dilute surfactant. 17 refs., 11 figs., 5 tabs.

12577 (NIPER—356) Microbial-enhanced waterflood field experiment. Bryant, R.S.; Burchfield, T.E.; Hitzman, D.O.; Porter, R.E. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Jan 1989. Contract FC22-83FE60149. 41p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000718/JAW.

A microbial-enhanced waterflood field project sponsored by the US Department of Energy (DOE), Microbial Systems Corp. (MSC), and INJECTECH, Inc., and being conducted in cooperation with the National Institute for Petroleum and Energy Research (NIPER) was initiated in October of 1986. The purpose of the project was to determine if injection of a microbial formulation could increase oil production in a mature waterflood. The site selected for the project is in the Mink Unit of the Delaware-Childers field in Nowata County, Oklahoma. The pilot area consists of four adjacent inverted five-spot patterns drilled on five-acre spacing. Baseline monitoring was conducted to establish pretest conditions from October 28, 1986, to March 17, 1987. Fluid samples were collected on a weekly basis from producing wells and analyzed for microbial populations, total dissolved solids (TDS), trace mineral analyses, pH, and oil viscosities. Other parameters measured included total oil production (Mink unit); total water production (Mink unit); injection well pressures and fluid rates from each well; and water-oil ratio from each well. Laboratory studies were conducted to screen microbes for the test. Several different microbial formulations were tested in Berea sandstone cores with Mink Unit water and crude oil to determine oil recovery efficiency. A core from the Delaware-Childers field was flooded with the microbial formulation selected for the project. The microbial system recovered 28% of the residual crude oil remaining in the core after waterflooding.

12578 **(NIPER—357) National Institute for Petroleum and Energy Research: FY89 annual research plan.** (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Nov 1988. Contract FC22-83FE60149. 99p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000701/JAW.

This is the sixth Annual Research Plan for the National Institute for Petroleum and Energy Research (NIPER). In its program of long-range research, NIPER is preparing for the time when petroleum scarcities again plague the United States. Two general study areas are addressed: (1) The consolidation and extension of enhanced oil recovery (EOR) technology. This includes reservoir characterization, chemical flooding, gas injection, steam injection, microbial EOR, and environmental concerns. (2) The development and improvement of knowledge concerning the manufacture and use of fuels from less desirable feedstocks. This includes the study of heavy petroleum, heavy ends of petroleum, tar sands, shale oil, and coal liquids. 2 refs., 2 figs., 3 tabs.

12579 **(NIPER—362) The use of entrainers for improving gas mobility control and displacement efficiency.** Llave, F.M.; Chung, F.T.H. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Nov 1988. Contract FC22-83FE60149. 41p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000704/JAW.

The use of entrainers to improve CO_2 mobility control for enhanced oil recovery was investigated. Entrainers serve as miscible additives that modify the phase behavior of supercritical solvents and enhance the solubility of crude oil components in the CO_2-rich phase. The presence of entrainers increases the viscosities and densities of gas phases. The improvement in supercritical extraction power and the enhancement of bulk fluid properties result in improved mobility ratios. Solution viscosities, densities, and solubilities of entrainers in gaseous carbon dioxide at 104{degree} and 122{degree}F (40{degree} and 50{degree}C) and pressures from 800 to 3200 psia (55.16 to 220.63 bars) were determined. Viscosity and density data were determined with a high-pressure capillary viscometer and a Mettler-Paar density meter. Results indicate that CO_2-rich phase viscosities and densities are increased when entrainers are solubilized into the gas phase. The effects of selected entrainers on the preferential solubilization of high-molecular-weight hydrocarbons into the gas phase were also determined. The addition of entrainers causes a preferential extraction of the heavier components of synthetic oils, in comparison with extraction by use of pure supercritical CO_2. Coreflooding and slim tube displacement experiments were performed to determine the effects of the presence of selected entrainers on oil displacement efficiency. Results indicate a delay in gas breakthrough and an increased oil recovery at breakthrough. 23 refs., 16 figs., 4 tabs.

12580 **(NIPER—369) Development of novel EOR [enhanced oil recovery] methods: Foams for mobility control in surfactant flooding.** Llave, F.M.; Sturm, J.M.; Olsen, D.K. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Jan 1989. Contract FC22-83FE60149. 44p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000715/JAW.

The use of foam as a novel method for mobility control in surfactant flooding was investigated. This report presents an initial evaluation of the potential application of foam as a mobility control agent behind a low concentration surfactant flood. This enhanced oil recovery (EOR) process involves the injection of alternate slugs of gas and surfactant solution as drive fluids behind the active surfactant slug front as an alternative to the use of polymers in order to eliminate unfavorable surfactant-polymer interactions. Experiments were performed to determine in situ foam generation and propagation using varying concentrations of surfactants in a Berea sandstone core. An apparatus was designed and built to accurately measure differential pressures along sections of the core. Bottle or shake tests using the various concentrations of surfactants and experiments to determine the effect of foam flow on reducing mobility and involved steady-state measurement of differential pressures in the presence of foam were performed. Coreflood displacement experiments in the presence of oil were performed using varying concentrations of surfactants to compare various injection modes and oil recovery efficiency. 15 refs., 18 figs., 5 tabs.

12581 **(NIPER—375) Low pH alkaline chemical formulations.** French, T.R.; Peru, D.A.; Thornton, S.D. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Jan 1989. Contract FC22-83FE60149. 55p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000724/JAW.

This report describes the development of a surfactant-enhanced alkaline flooding system that is applicable to specific reservoir conditions in Wilmington (California) field. The cost of the chemicals for an ASP (alkali/surfactant/polymer) flood is calculated to be $3.90/bbl of oil produced, with 78% of that cost attributable to polymer. This research included phase behavior tests, oil displacement tests, mineral dissolution tests, and adsorption measurements. It was discovered that consumption of low pH alkalis is low enough in the Wilmington field to be acceptable. In addition, alkali dramatically reduced surfactant adsorption and precipitation. A mixture of $NaHCO_3$ and Na_2CO_3 was recommended for use as a preflush and in the ASP formulation. Research was also conducted on the synergistic effect that occurs when a mixture of alkali and synthetic surfactant contacts crude oil. It appears that very low IFT is predominantly a result of the activation of the natural surfactants present in the Wilmington oil, and the sustained low IFT is primarily the result of the synthetic surfactant. It also appears that removal of acids from the crude oil by the alkali renders the oil more interfacially reactive to synthetic surfactant. These phenomena help to explain the synergism that results from combining alkali and synthetic surfactant into a single oil recovery formulation. 19 refs., 24 figs., 10 tabs.

12582 **(NIPER—398) NIPER [National Institute for Petroleum and Energy Research]: Quarterly technical report for July 1--September 30, 1988.** (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). 4 Jan 1989. Contract FC22-83FE60149. 217p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005217/JAW.

The Quarterly Technical Report, NIPER-398, covers the period July 1 to September 30, 1988, and reports on the research program outlined in the "FY88 Annual Research Plan." It is submitted in accordance with the provisions of Cooperative Agreement FC22-83FE60149 between the Department of Energy and the IIT Research Institute.

12583 **(NMRDI—2-75-5340) Improvement of CO_2 flood performance: Third annual report, October 1, 1986--September 30, 1987.** Heller, J.P.; Kovarik, F.S.; Taber, J.J. (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center). Nov 1988. Contract FC21-84MC21136. 340p. (PRRC—87-9). NTIS, PC A15/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004697/JAW.

This report provides results obtained for the third year of a three-year, comprehensive, cost-shared, applied research program to improve oil recovery through carbon dioxide (CO_2) flooding. The program was composed of three areas: Task 1--Phase Behavior and Fluid Property Measurements, Task 2--Mixing of CO_2 and Oil During Flow in Reservoir Rocks, and Task 3--Mobility Control in CO_2 Floods. In Task 1, the continuous phase equilibrium apparatus was used to measure simultaneously the viscosity, density, and composition of CO_2-hydrocarbon systems at high pressure. These data were compared to a well-known correlation used in predicting viscosities in reservoir simulation studies. Other work in this area consisted of slim-tube tests using CO_2 and both a synthetic and a crude oil in order to study the effects of methane on optimum oil recovery with CO_2. In Task 2, the performances of secondary and tertiary displacements of crude oil by CO_2 in cores were measured and compared to predictions made with a multicomponent, one-dimensional simulator. Results from the core tests suggest that it may be possible to achieve optimum oil recovery with CO_2 at pressures which are lower than the conventionally obtained optimum pressure estimated from a slim-tube test. In the final part of this task, flow visualization experiments were conducted in glass micromodels to study the effect of micro-heterogeneity on the flow of CO_2 and surfactant-generated foam. In Task 3, procedures and equipment were developed to measure the steady-state mobility of foam-

like dispersions of dense CO_2 in surfactant solutions. 74 refs., 116 figs., 31 tabs.

12584 **(PB—89-852891/XAB) Enhanced petroleum recovery using steam. January 1970-December 1988 (Citations from the COMPENDEX data base). Report for January 1970-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 105p. NTIS PC N01/MF N01.

This bibliography contains citations concerning the feasibility, prediction, performance, and economics of increasing oil recovery by use of gas- and steam-injection techniques in a variety of geological conditions. Topics include analyses and simulations of reservoir performance, injection-system design, injection-pattern effects, and recovery procedures and mechanisms. Fluid-flow effects, oil-saturation studies, and descriptions of specific operations are discussed. (Contains 215 citations fully indexed and including a title list.)

12585 **(PB—89-853485/XAB) Enhanced petroleum recovery using carbon dioxide. January 1970-December 1988 (Citations from the COMPENDEX data base). Report for January 1970-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 84p. NTIS PC N01/MF N01.

This bibliography contains citations concerning the use of carbon dioxide in production-well stimulation and enhanced-recovery operations. Topics include laboratory and theoretical investigations of phase behavior, field studies, and gas-recovery methods. Some attention is given to modeling, and to safety concerns. (Contains 159 citations fully indexed and including a title list.)

12586 **(UCID—21505) Physical models of hydrofracturing across material interfaces.** Blair, S.C.; Thorpe, R.K.; Heuze, F.E. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006075/JAW.

We have performed a series of laboratory tests to study the propagation of a hydrofracture into and through an interface between two rock-like materials. The aim of this research is to provide improved diagnostics for stimulating lenticular gas sand reservoirs by interpreting features of the injection pressure-time record caused by interaction of a hydrofracture with a geologic discontinuity. Results will also be used to validate conceptual models of hydrofracture behavior in discontinuous media, such as are embodied in the LLNL FEFFLAP code, a two-dimensional fracture propagation computer program. We prepared test specimens by embedding sandstone tablets (lenses) in blocks of gypsum cement. These blocks were hydrofractured under true triaxial loading conditions, at a constant injection rate. The injection path was designed so that we obtained a single-wing fracture, propagating in a plane perpendicular to the interface. The vertical extent of the fractures was controlled by means of wire mesh screen embedded in the blocks, perpendicular to the injection tube. Growth of the fractures was tracked via extension failure of fine tungsten wires embedded in the gypsum. After testing, we dissected the blocks and recorded the extent of fracturing and fluid penetration. Cross-sections of the fractures indicate that they were of constant height and propagated through the sandstone tablet. All the fractures showed step-crack behavior upon entering or exiting the sandstone tablet. Pressure-time and fracture tracking data were consistent for all tests. Distinct step increases on the pressure- time record were also noted in all tests, and are related to the interaction of the hydrofracture with the sandstone lens. 16 refs., 19 figs., 4 tabs.

12587 **Sweep improvement in CO/sub 2/ flooding by use of foaming agents.** Casteel, J.F.; Djabbarah, N.F. *SPE (Society of Petroleum Engineers) Reservoir Engineering;* **3**: No. 4, 1186-1192(Nov 1988).

This study has two objectives: (1) to screen and select foaming agents for specific CO/sub 2/ floods and (2) to determine the effectiveness of foam in improving sweep efficiency in CO/sub 2/ flooding. Foaming agents were evaluated on their ability to produce ample, lasting foam and to have low loss from adsorption on reservoir rock and decomposition at reservoir conditions. Foaming agents that performed well in shaking, blender, long-term stability, and high-pressure stability tests were selected for core-flow experiments. The stability test results demonstrated that foaming agents are reservoir-specific. The extent of the loss depends on the foaming agent, reservoir fluids, reservoir lithology, and reservoir conditions. The core-flow experiments involved the simultaneous injection of CO/sub 2/ into two waterflooded Berea cores. The cores were arranged in parallel and had different permeabilities. The test temperature and pressure was constant and above the critical conditions for CO/sub 2/. Three types of core-flow tests, involving injection of CO/sub 2/ to displace oil, injection of alternate slugs of CO/sub 2/ and brine, and injection of foaming agents, were conducted. The foaming agents were injected before CO/sub 2/ injection and after CO/sub 2/ had displaced oil from the more permeable core. The results show that in-situ foam generation is an effective method for improving CO/sub 2/ displacement efficiency. Foam was most effective when the foaming agent was injected after CO/sub 2/ displaced the oil from the more permeable core. The improved sweep efficiency was caused by the tendency of the foam to be generated preferentially in the more permeable core. The foam increased resistance to flow in this core and caused more CO/sub 2/ to flow through the less permeable core. The second injection method is also more applicable to field implementation.

0204 Processing

REFER ALSO TO CITATION(S) 12596

12588 **(DOE/PC/80017—T1) Fischer-Tropsch wax characterization and upgrading: Final report.** Shah, P.P.; Sturtevant, G.C.; Gregor, J.H.; Humbach, M.J.; Padrta, F.G.; Steigleder, K.Z. (UOP, Inc., Des Plaines, IL (USA); Allied-Signal, Inc., Des Plaines, IL (USA). Engineered Materials Research Center). 6 Jun 1988. Contract AC22-85PC80017. 325p. NTIS, PC A14/MF A01 - OSTI; 1; GPO Dep. Order Number DE88014638/JAW.

The characterization and upgrading of Fischer-Tropsch wax was studied. The focus of the program was to maximize the yield of marketable transportation fuels from the Fischer-Tropsch process. The wax was characterized using gel permeation chromatography (GPC), high resolution mass spectrometry (HRMS), infrared spectroscopy (IR), gas chromatography (GC), nuclear magnetic resonance (NMR) and various other physical analyses. Hydrocracking studies conducted in a pilot plant indicate that Fischer-Tropsch wax is an excellent feedstock. A high yield of excellent quality diesel fuel was produced with satisfactory catalyst performance at relatively mild operating conditions. Correlations for predicting key diesel fuel properties were developed and checked against actual laboratory blend data. The blending study was incorporated into an economic evaluation. Finally, it is possible to take advantage of the high quality of the Fischer-Tropsch derived distillate by blending a lower value light cycle oil (produced from a refinery FCC unit) representing a high aromatic and low cetane number. The blended stream meets diesel pool specifications (up to 60 wt % LCO addition). The value added to this blending stream further enhances the upgrading complex return. 22 refs., 39 figs., 48 tabs.

0205 Products And By-products

REFER ALSO TO CITATION(S) 12582, 13084, 13861

12589 **(AD-A—200250/9/XAB) Fuel property and antioxidant effects on elastomer integrity. Phase 2. Final report, September 1985-February 1988.** Cuellar, J.P. (Southwest Research Inst., San Antonio, TX (USA). Fuels and Lubricants Research Div.). Mar 1988. 33p. (SWRI—8845-002). NTIS, PC A03/MF A01.

Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

The program objective was to determine if typical antioxidants used in JP-5 turbine fuel could exhibit harmful effects on fuel system elastomers as a consequence of chemical change of the antioxidants during the inhibition process. One stable and one unstable fuel (relative to peroxidation tendency), with and without an anti-

oxidant, were stored at 43C in contact with 14 elastomer materials. Storage periods ranged from 7 to 270 days. Post-storage elastomer results indicated no deleterious effect attributable to the antioxidants. Significant changes in elastomer properties were confined to the uninhibited, unstable fuel which developed appreciable levels of peroxides over the course of the study.

12590 **(NIPER—352) Stability, compatibility, and related problems of additives in naval distillate fuels derived from lower quality feedstocks.** Stirling, K.Q.; Brinkman, D.W. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Jan 1989. Contract FC22-83FE60149. 37p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000717/JAW.

This report documents a study to determine which antioxidants are most effective in delaying fuel degradation in a variety of straight-run middle distillate/light cycle oil (LCO) fuel blends which are similar to Naval Distillate Fuel. The fuel additives blends described in this report contain 30% LCO. The additives were blended into the fuels at a concentration of either 24 or 50 ppm on the basis of the entire package, not the active ingredient. In order to properly evaluate the efficacy of the additive, several freshly refined fuels were used. This is necessary because additives do not behave the same in all fuels. This report contains storage stability and fuel characterization data for seven different sets of blends. 16 refs., 12 tabs.

12591 **(PB—89-853055/XAB) Aviation-fuel additives. January 1970-December 1988 (Citations from the NTIS data base). Report for January 1970-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 127p. NTIS PC N01/MF N01.

Supersedes PB—88-856059.

This bibliography contains citations concerning research and development of aviation-fuel additives, together with pertinent characteristics. Included are studies on antioxidants, antimist, antistatic, lubricity, corrosion inhibition, and icing-inhibition additives. Other characteristics are covered in investigations into additives for vulnerability reduction, thermal stability, and storage stability of aviation fuels. (This updated bibliography contains 190 citations, 19 of which are new entries to the previous edition.)

0206 Health And Safety

REFER ALSO TO CITATION(S) 13042

12592 **(IT—1987) New ideas to enhance the bottom line.** (Info-Tech, Calgary, Alberta (Canada)). 1987. 75p. (CONF-8706369—; CE—02138). Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN.

From Hydrocarbon and chemical plant operations and maintenance; Edmonton, Canada (3 Jun 1987).

This conference dealt with methods for management of health and safety, and loss control programs in petrochemical plants. Separate abtracts were prepared for five papers.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 12603

12593 **(DOE/EIA—0035(88/10)) Monthly energy review, October 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 26 Jan 1989. 144p. NTIS, PC A07/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89006231/JAW.

The United States produced 1.6 percent more energy during the first 10 months of 1988 than during the same period in 1987, and US consumption was up 4.2 percent. Net imports of all energy were 5.2 percent higher than during the first 10 months of 1987. Energy production during October 1988 totaled 5.4 quadrillion Btu, a 2.6-percent decrease compared with the level of production during October 1987. Coal production decreased 6.3 percent, petroleum production was down 3.7 percent, while natural gas production increased slightly. All other forms of energy production combined were up 6.0 percent from the level of production during October 1987. Energy consumption during October 1988 totaled 6.4 quadrillion Btu, 3.0 percent above the level of consumption during October 1987. Coal consumption increased 4.2 percent, petroleum consumption rose 3.2 percent, and natural gas consumption increased 0.8 percent. Consumption of all other forms of energy combined also increased, up 4.2 percent compared with the level 1 year earlier. Net imports of energy during October 1988 totaled 1.1 quadrillion Btu, 3.2 percent above the level of net imports 1 year earlier. Net imports of natural gas increased 14.8 percent, and net imports of petroleum were up 7.9 percent. Net exports of coal increased 34.3 percent compared with the level in October 1987.

12594 **(GAO/RCED—88-145FS) Energy management.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 1988. 29p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

In 1978, the Department of Energy charged the Exxon Corporation with overpricing crude oil which resulted in overcharges to its customers. DOE ordered Exxon to pay the agency, as restitution for the overcharges, $2.098 billion in principal and interest which DOE disbursed to the states. Stripper Well fund distributions totaling $854 million as of June 1987 made to states were the result of allegations that crude oil producers had miscertified federally controlled crude oil to avoid price restrictions. As of June 1987, most of the Exxon funds that states had obligated or spent went to three energy conservation/energy assistance programs - Weatherization Assistance Program, State Energy Conservation Program, and the Low-Income Home Energy Assistance Program. While states may also use Stripper Well funds for these programs, most of the funds states have obligated or spent have gone to other authorized programs.

12595 **(PB—89-123509/XAB) World petroleum markets: a framework for reliable projections, the Petroleum Finance Company, Ltd. World Bank technical paper.** (International Bank for Reconstruction and Development, Washington, DC (USA)). 1988. 191p. (WORLD-BANK-TP—92). NTISMF A01.

Library of Congress catalog card no. 88-27843; Microfiche copies only. Paper copy available from World Bank, 1818 H St., NW, Washington, DC 20433.

This report summarizes the principal factors that influence long-run conditions in the petroleum markets and presents a framework for projecting crude oil prices, based on leading economic indicators, that is more reliable than other forecasting approaches. The report is based on analysis of oil-market conditions over a period of more than 100 years. The data base collected by The Petroleum Finance Company and used to develop leading and lagging indicators of the world petroleum cycle is readily available from public sources. The forecasting approach proposed in the report is based on the hypothesis that the characteristics of the oil market produce cyclical patterns in the industry's activity and oil prices. The long-run future of the world oil market can be projected as a continuation of the cycles of expansion and contraction. The indicators proposed in the report were developed from limited work. The interesting results thus achieved show the potential of this approach. Further development work could lead to the identification of better indicators of the timing and amplitudes of future cycles in oil prices, thereby improving the credibility of this approach for use in an investment or policy-making framework.

0208 Waste Management

12596 **(PB—89-125991/XAB) Technology-evaluation report: site program-demonstration test, Shirco Infrared Incineration System, Peak Oil, Brandon, Florida. Volume 1.** Rosenthal, S.; Wall, H.O. (Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab.). Sep 1988. 107p. (EPA—540/5-88/002A). NTIS, PC A06/MF A01.

See also Volume 2, PB—89-116024.

A Shirco Infrared System used for a removal action at a PCB-containing oil-refining waste site in Brandon, Florida (a suburb of Tampa) was evaluated. The evaluation included a deter-

mination of toxics in the material being decontaminated as well as all the effluent streams such as ash, air emissions and wastewater. These streams were analyzed for heavy metals, organics, dioxins, furans, as NOx, and inorganic acids. Leaching tests were performed on the ash. The results indicated that the PCB was reduced from 5 to 100 ppm to less than 1 ppm in the ash, which was the purpose of the removal action. Although research had indicated that the lead compounds in the ash would become insoluble because they would be complexed with carbon, the ash could not be considered non-leachable based on toxicity tests.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 12608, 12609, 13560, 13561, 13562, 13563, 13564, 13565, 13570, 13574, 13581

12597 **(EGG-M—88236) Annular centrifugal contactors as rapid oil-water separation devices.** Meikrantz, D.H.; Bourne, G.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1989. Contract AC07-76ID01570. 11p. (CONF-890202—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005432/JAW.

From Biennial international oil spill conference; San Antonio, TX, USA (13 Feb 1989).

The results of preliminary tests to apply devices known as annular centrifugal; contactors to the rapid separation of oil-water mixtures are presented. Separation efficiencies of oil from water of >99% have been demonstrated on both light and heavy oils. Equilibrium within the separating zone of the contactor is reached within seconds. Dynamic testing in which water to oil flow ratios of 1:5 and 5:1 have been conducted without loss of performance. The laboratory scaled contactors tested have total throughput of 80 cc/min. The design and construction of larger devices with total throughputs of hundreds of gallons per minute is feasible. Such contactors would be compact units capable of allowing rapid recovery from a broad range of hydrocarbon spills on waterways. The efficiency of these contactors is such that water discharged can be returned to the environment. Recovered hydrocarbons may be useful without further refinement.

12598 **(PB—89-124754/XAB) Interpreting residues of petroleum hydrocarbons in wildlife tissues.** Hall, R.J.; Coon, N.C. (Patuxent Wildlife Research Center, Laurel, MD (USA)). Aug 1988. 15p. (BIOLOGICAL—88(15)). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 88-600320.

This report is the first publication in the field of environmental-contaminant effects on wildlife to tell the reader how to interpret the results of analytical chemical results. Specifically, the publication describes how to interpret residues of petroleum hydrocarbons in wildlife tissues. Pollutant oil residues in avian species are emphasized.

12599 **(PB—89-126684/XAB) Risk analysis model for marine mammals and seabirds: a southern California bight scenario. Final report.** Ford, R.G. (Ecological Consulting, San Diego, CA (USA)). May 1985. 264p. NTIS, PC A12/MF A01.

The objective of this study was to model the risks to selected species of marine mammal and seabird populations in the Southern California Bight from oil spills during OCS oil and gas development and operations. Risk analysis is a procedure designed to investigate the possible negative effects of projects and activities. The conventional approach to analyzing oil and gas reserves is through the use of the MMS Oil Spill Risk Analysis Model (OSRAM) OSRAM was developed to aid in estimating the environmental hazards of developing oil resources in OCS lease areas. Two other computer models were used in these analyses. They are: (2) the short-term oil response model, STORM and (3) the oil-spill population response model, OSPREY. In the report, a methodology for describing the range of consequences which oil spills might have on Southern California Bight seabird and marine mammal populations and the likelihood of those effects were developed. Two general categories of spill consequences were examined: (1) the immediate mortality to a population caused by a spill from a given source, and (2) the long term marine mammal and seabird populations effects of the projected Southern California Bight OCS development.

12600 **(PB—89-128151/XAB) California OCS (Outer Continental Shelf) Phase 2 monitoring program, year-one annual report. Volume 1.** Hyland, J.; Neff, J. (Battelle Memorial Inst., Ventura, CA (USA)). 29 Jan 1988. 606p. NTIS, PC A99/MF A01.

See also Volume 2, PB—89-128169. Color illustrations reproduced in black and white.

This study concentrates on benthic biological communities off southern California, but results may be applied to other Pacific OCS Planning Areas. The study is intended to detect and measure long-term (or short-term) changes in the marine environment in the vicinity of OCS oil and gas development and production activities; and to determine whether changes observed in the marine environment during the monitoring period are caused by drilling and production-related activities or reflect natural processes. The station design consists of a series of regional stations and two arrays of site-specific stations located in the vicinity of one existing, and one planned oil development/production platforms. Both arrays consist of a series of platform and comparison stations.

12601 **(PB—89-128169/XAB) California OCS (Outer Continental Shelf) Phase 2 monitoring program, year-one annual report. Volume 2. Appendices.** Hyland, J.; Neff, J. (Battelle Memorial Inst., Ventura, CA (USA)). 29 Jan 1988. 193p. NTIS, PC A09/MF A01.

See also Volume 1, PB—89-128151.

This study concentrates on benthic biological communities off southern California, but results may be applied to other Pacific OCS Planning Areas. The study is intended to detect and measure long-term (or short-term) changes in the marine environment in the vicinity of OCS oil and gas development and production activities; and to determine whether changes observed in the marine environment during the monitoring period are caused by drilling and production-related activities or reflect natural processes. The station design consists of a series of regional stations and two arrays of site-specific stations located in the vicinity of one existing, and one planned oil development/production platforms. Both arrays consist of a series of platform and comparison stations.

12602 **Environmental management practices in oil refineries and terminals: An overview.** Paris, France; United Nations Environment Programme (1987). 106p. Issuing Activity.

Within the concept of the UNEP (UN Environmental Programme) ongoing review of the environmental effects of specific industries, a seminar was held in Paris in March 1977 on the petroleum industry. An overview document, Environmental Aspects of the Petroleum Industry, was published in 1978 as a synthesis of their evaluation. It discusses policy aspects of the environmental issues to enable appropriate action to take place. To provide a forum for consultation and communication to exchange experiences among governments, industry and relevant international institutions, UNEP established an Environmental Consultative Committee on the Petroleum Industry which held its first meeting in Paris in September 1978 and second in the same city in June 1981. A broad range of views and information were exchanged, such as the environmental impact of oil exploration and production, marine transportation, aspects of pipeline construction and operation, refining, oil spill control, long term effects on hydrocarbons on the marine environment, sulphur in petroleum and its role in acid rain, disposal of oily wastes, environmental management in refineries, terminals, coastal installations, etc.

0210 Legislation And Regulation

12603 **(DOE/CH/10381—1) State uses of Exxon and Stripper well oil overcharge funds: Status report.** (National Consumer Law Center, Washington, DC (USA)). Nov 1988. Contract FG02-88CH10381. 54p. The National Consumer Law Center, 236 Massachusetts Avenue, N.E., Washington, DC 20002. Order Number TI89004478/JAW.

This report incorporates information collected by National Consumer Law Center in telephone surveys conducted primarily from August through October, 1988. The information collected on the status and state uses of both Exxon and Stripper Well funds is

contained in four sections: Section I provides background information regarding the two main sources of oil overcharge funds distributed to the states since 1986. Section II provides a brief overview of NCLC's findings on the status of state allocation decisions and on specific uses of these funds. Section III of the report gives specific examples of some of the programs or projects funded with the money, with an emphasis on low-income uses. Section IV contains important notes relating to a series of nine tables.

0230 Properties

REFER ALSO TO CITATION(S) 12532, 12578, 12590, 13179

12604 **(DOE/ER/13702—1) A model approach to vanadium in crude oils and their refining: Progress report.** Christou, G. (Indiana Univ., Bloomington (USA)). [1988]. Contract FG02-87ER13702. 3p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004862/JAW.

We have been continuing our two-pronged attack on the question of the nature of the vanadium impurities in crude oils and the mechanistic chemistry of their subsequent conversion to sulfur-containing intermediates on the way to formation of insoluble vanadium sulfides; the latter deposit on and contribute to poisoning of the Mo HDS catalyst.

12605 **(NIPER—345) The thermodynamic properties of 4-methylphenanthrene: Application of the group-contribution methodology to alkyl-aromatics.** Chirico, R.D.; Hossenlopp, I.A.; Nguyen, A.; Steele, W.V. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Jan 1989. Contract FC22-83FE60149. 42p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000716/JAW.

Measurements leading to the calculation of the ideal-gas thermodynamic properties for 4-methylphenanthrene are reported. Thermochemical and thermophysical properties were determined by adiabatic heat-capacity calorimetry, combustion calorimetry, comparative ebulliometry, and inclined-piston manometry. Results were used to calculate entropies, enthalpies, and Gibbs energies of formation for the ideal-gas state at selected temperatures to 500 K. Group-contribution methods involving intercomparisons for a series of methyl-substituted aromatic molecules were used to demonstrate the consistency of ideal-gas entropies and the enthalpy of formation determined for 4-methylphenanthrene with literature values for related compounds and with a barrier to methyl rotation from the literature determined using nuclear magnetic resonance (NMR) spectroscopy. 52 refs., 4 figs., 16 tabs.

12606 **(NIPER—363) Infrared-chemical derivatization method for determination of total hydroxyls and carboxyls in petroleum and syncrudes.** Yu, S.K-T; Green, J.B. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Sep 1988. Contract FC22-83FE60149. 33p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004684/JAW.

Oxygen-containing functional group (hydroxyl and carboxyl) in fuels or crude oils, or fractions thereof, are determined by RI spectroscopy. The approach is based on chemical derivatization followed by measurement of RI bands of the corresponding derivatives. The chemical derivatization procedure involves two steps: (1) esterification of carboxylic acids with 2,2,2-trifluoroethanol and (2) acylation of alcoholic and phenolic hydroxyls with trifluoroacetyl chloride. The aryl trifluoroacetates absorb at 1800 cm/sup {minus}1/; the 2,2,2-trifluoroethyl esters absorb in the region 1760-1740 cm/sup {minus}1/. Variation of molar absorptivity of the derivatives as a function of structure is determined using pure compounds and well defined fractions from actual fuel samples. The overall accuracy, precision, sensitivity, and range of applicability to petroleum and related sample types are discussed. 52 refs., 3 figs., 9 tabs.

12607 **A correlation for thermodynamic properties of heavy fossil-fuel fractions.** Schwarz, B.J.; Prausnitz, J.M. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US));. *Industrial and Engineering Chemistry Research;* **27**: No. 5, 882-891(May 1988).

A correlation is developed for calculation of thermodynamic properties of heavy fossil fuels, based on a recent version of the perturbed-hard-chain equation of state. Since the correlation does not require experimental vapor pressure or densities as input data, it is useful for heavy fossil fuels where vapor pressures and densities are difficult or impossible to measure. For fossil-fuel fractions, equation-of-state parameters are found from approximate molecular-structure (characterization) data coupled with a calibration based on pure-component (model-compound) data. Interaction parameters are given for mixtures of fossil fuels with methane, ethane, carbon dioxide, hydrogen, and hydrogen sulfide. While the correlation presented here is useful for calculating vapor-liquid equilibria, it is not intended for conventional fossil fuels, where other correlations are satisfactory. Instead, it is intended for heavy fossil fuels where conventional correlations are often not reliable and where the usual input data are often unavailable.

0240 Storage

REFER ALSO TO CITATION(S) 12582

12608 **(PB—89-124333/XAB) Evaluation of volumetric leak-detection methods for underground fuel-storage tanks. Volume 1. Final report, September 1986-July 1987.** Roach, R.D.; Starr, J.W.; Maresca, J.W. (Vista Research, Inc., Mountain View, CA (USA)). Nov 1988. 337p. NTIS, PC A15/MF A01.

See also Volume 2, PB—89-124341.

This report summarizes the results of a research program to evaluate the current performance of 25 commercially available volumetric test methods for the detection of small leaks in underground gasoline-storage tanks. The leak rate measurable by these systems ranged from 0.26 to 6.97 L/h (0.07 to 1.84 gal/h), with a probability of detection of 95% and probability of false alarm of 5%. Only one of the methods achieved a performance better than 0.56 L/h, but five methods achieved a performance between 0.56 L/h and 0.95 L/h. The measured performance was considerably poorer than the often-claimed 0.19 L/h (0.05 gal/h). The report can be of value in estimating the impact of system improvements, but any new claims of improved performance, to be completely credible must be supported, in most cases, by additional experimental and analytic evidence.

12609 **(PB—89-124341/XAB) Evaluation of volumetric leak-detection methods for underground fuel-storage tanks. Volume 2. Technical appendices. Final report, September 1986-July 1987.** Roach, R.D.; Starr, J.W.; Maresca, J.W. (Vista Research, Inc., Mountain View, CA (USA)). Nov 1988. 977p. NTIS, PC A99/MF E06.

See also Volume 1, PB—89-124333.

This report summarizes the results of a research program to evaluate the current performance of 25 commercially available volumetric test methods for the detection of small leaks in underground gasoline-storage tanks. The leak rate measurable by these systems ranged from 0.26 to 6.97 L/h (0.07 to 1.84 gal/h), with a probability of detection of 95% and probability of false alarm of 5%. Only one of the methods achieved a performance better than 0.56 L/h, but five methods achieved a performance between 0.56 L/h and 0.95 L/h. The measured performance was considerably poorer than the often-claimed 0.19 L/h (0.05 gal/h). The report can be of value in estimating the impact of system improvements, but any new claims of improved performance, to be completely credible must be supported, in most cases, by additional experimental and analytic evidence.

03 NATURAL GAS

0301 Reserves

REFER ALSO TO CITATION(S) 12562

0302 Geology And Exploration

12610 **(DOE/MC/24264—2621) Multiwell Experiment (MWX) stimulation data review, in situ stress analysis.** Smith, M.B. (Nolte-Smith, Inc., Tulsa, OK (USA)). Jul 1988. Contract AC21-87MC24264. 252p. NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE88010274/JAW.

The MWX experiments conducted in the Mesaverde Group in Colorado have created a comprehensive data base of fracturing tests and measured hydraulic fracturing behavior. Since in situ stresses are the primary control mechanism over fracture geometry, a significant portion of the pre-frac "fracture" testing was concerned with stress tests. As the first step in evaluating the final utility of the stress testing program in terms of: (1) testing theories of fracture geometry in a field scale environment, and (2) examining the usefulness of pre-frac testing for improving the predictability of well stimulations; much of the in situ stress test data collected in the MWX wells was reviewed, and, in some instances, re-analyzed. The immediate goals of this review, as reported on here, were to: confirm the stress results showing that significant stress differences can exist in lenticular formations, to evaluate the micro-frac stress testing procedure utilized for the MWX wells, and to examine correlations between measured stresses and other formation properties. Either the actual stress test data, or a formation property correlation, would then be used to generate a stress profile for each stimulated zone (e.g., Paludal, Coastal, and Fluvial) in the Mesaverde Group. These stress profiles will form the basis for subsequent fracturing analysis to compare predicted versus actual fracture behavior, and thus test fracturing theories and evaluate the utility of pre-frac testing. 15 refs., 37 figs., 4 tabs.

12611 **(PB—89-126247/XAB) Analysis of borehole stability and drilling fluids for SFE (staged field experiment) No. 2. Topical report.** Monson, E.R. (CER Corp., Las Vegas, NV (USA)). Jun 1988. 66p. NTIS, PC A04/MF A01.

The Gas Research Institute's (GRI) Tight Gas Sands program is actively engaged in collecting geophysical data from the Travis Peak formation in the East Texas Basin. Poor-quality electrical wireline measurements and disintegrating core were observed in eight GRI cooperative wells and in the first Staged Field Experiment well. The adverse conditions contributing to the poor-quality data were attributed to unstable borehole conditions resulting from geochemical reactions between formation clays and the drilling-fluid water, causing them to swell. Tests performed on a section of core from a well within one mile of the second Staged Field Experiment well using eight different drilling fluids indicated a water-base drilling fluid with potassium chloride and a shale inhibiting polymer would enhance borehole stability. This drilling fluid system's ability to prevent clay swelling and promote geophysical data quality was determined by analyzing caliper logs, wireline log data quality and whole core.

12612 **(SAND—88-1800) Characterization of natural fractures in Mesaverde core from the multiwell experiment.** Finley, S.J.; Lorenz, J.C. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 138p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004505/JAW.

Natural fractures dominate the permeability of tight sandstone reservoirs in the Mesaverde Formation of the Piceance Creek Basin, north-western Colorado. Roughly 1900 natural fractures, detected in 4200 ft of Mesaverde core from the US Department of Energy's Multiwell Experiment (MWX), have been differentiated into 10 different fracture types on the basis of fracture morphology, inclination, the presence of slickensides, the presence of dickite mineralization and/or host lithology. Approximately 75% of the MWX core fractures are dewatering planes in mudstone and are probably unimportant to reservoir permeability. The remaining 25% of the MWX core fractures include 275 mostly calcite-mineralized, vertical extension fractures, 61 irregular, dickite-mineralized extension fractures, 27 mostly calcite-mineralized, horizontal extension fractures, and 90 slickensided, occasionally mineralized shear fractures. These extension and shear fractures are all potentially important to reservoir permeability and consequently productivity. 13 refs., 61 figs., 2 tabs.

0303 Drilling, Production, And Processing

12613 **(DOE/MC/23063—2635) Measurement and modeling of hydrate dissociation: Final report.** Sloan, E.D.; Selim, M.S. (Colorado School of Mines, Golden (USA). Dept. of Chemical Engineering and Petroleum Refining). Apr 1988. Contract FG21-86MC23063. 93p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000911/JAW.

Natural gas could be recovered from hydrate deposits by either of two basic methods (1) thermal stimulation in which an external source of energy is provided and (2) lowering of the equilibrium pressure (depressurization) in which the energy of the hydrate-containing and the surrounding media is utilized. In this work, we have measured and modeled mathematically the dissociation of hydrates in consolidated and unconsolidated porous media. Hydrates were formed in laboratory samples of Ottawa sand and Berea sandstone using miscible and non-miscible hydrate formers. A state-of-the-art, computer-controlled transient hot wire needle probe apparatus was developed for the measurements of thermal conductivity of pure hydrates and hydrate-containing porous media. We have measured the thermal conductivity of hydrate-containing Ottawa sand and Berea sandstone samples in order to determine the physical properties necessary for the mathematical models. We have also measured the electric resistivity of methane hydrate-containing Berea sandstone in order to verify the formation of the hydrate and to track the dissociation front during hydrate depressurization. Two mathematical models were developed for the process of hydrate dissociation in porous media using the two recovery schemes thermal stimulation and depressurization. 10 refs., 9 figs., 1 tab.

0305 Health And Safety

12614 **(PB—89-133789/XAB) Environmental control of gas appliances: development and field test of a method for detecting unacceptable flue-gas leakage from heat exchangers. Annual report, July 1982-June 1983.** DeWerth, D.W.; Connelly, S.M. (American Gas Association Labs., Cleveland, OH). Aug 1983. 54p. NTIS, PC A04/MF A01.

See also PB—83-228320.

A method developed for detecting unacceptable leakage of flue gases through heat exchangers was field tested by 7 utilities. Over 70 field-test reports were made using the A.G.A.L. tracer gas method. The method was shown to be acceptable to utility servicemen and was proven to be more reliable and accurate than most currently used procedures. In several of the field-test reports, the tracer-gas method proved to be the only test yielding the correct result. The method consists of a visual check of the heat exchanger, and the burner-flame stability. Then the heat exchanger is flooded with a 14.3% CH_4 mixture in N_2 and a suitably calibrated combustible gas detector is used to detect the CH_4 in the circulating air side of the heat exchanger. A calibrated alarm light indicates an unacceptable leakage.

0306 Marketing And Economics

12615 **(PB—89-129209/XAB) Competitive position of natural gas: ferrous forging. Topical report, October 1987-July 1988.** Minsker, B.S.; Hoerl, J.D.; Desai, T.M.; Salama, S.Y. (Energy and Environmental Analysis, Inc. Arlington, VA (USA)). Jul 1988. 100p. NTIS, PC A05/MF A01.

Ferrous forging is an important industrial metal-fabrication process and gas market that is facing increased competition from imports and electric technologies. In 1985, the production of fer-

rous forgings totaled approximately 1.3 million tons with a value of $3.1 billion. The forging industry consumed approximately 6.8 trillion Btu in 1985. Of this total, 4.2 trillion Btu was natural gas. The results of this study indicate that electric-heating technologies have, and will continue to penetrate the small workpiece forging market, but that natural gas technologies are preferred in applications which require intermediate reheating or the ability to heat a variety of shapes and sizes in the same furnace.

0308 Environmental Aspects

REFER ALSO TO CITATION(S) 12599, 12600, 12601, 12819, 13561, 13562, 13563, 13564, 13565

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 12610

0320 Transport, Pipelines, And Handling

12616 **(PB—89-126221/XAB) System and material specifications for an advanced gas-distribution system, Task 1: strengths and weaknesses of current distribution system. Topical report, December 1987-June 1988.** Lipinsky, E.S.; Hattery, G.R.; Wenzel, A.E. (Battelle Columbus Div., OH (USA)). Sep 1988. 65p. NTIS, PC A04/MF A01.

Three major strengths of the present gas-distribution system were identified: (1) the fuel transported which is natural gas readily available, clean, low in overall cost, and does not create inventory problems for its users; (2) the strong customer base that includes industrial, residential, and commercial users; and (3) the strong strategic position of the system in which the conduits are in protected underground locations. The principal weaknesses include: (1) problems in expanding the system to include new customers; (2) increasing problems with third-party damage (harm to the pipeline caused by digging or construction by an organization that is neither the customer nor the gas utility); (3) difficulty in locating buried system elements and leaks; (4) load management problems that are symptoms of information-management problems.

12617 **(PB—89-131155/XAB) System and material specifications for an advanced gas-distribution system. Task 2. Ddentification and evaluation of future gas customers. Topical report, December 1987-June 1988.** Hanny, D.; Sheppard, W.; Hattery, G. (Battelle Columbus Div., OH (USA)). Nov 1988. 97p. NTIS, PC A05/MF A01.

Forecasts of supply/demand for conventional uses of natural gas through the year 2010 were made as well as an assessment of the potential of several alternative fuel systems and competitive fuels. Three scenarios were established that addressed probable environments for the gas supply/demand through 2010. In all cases, the bulk of natural gas used in U.S. will still be produced in the lower 48 States. Significant results of the evaluation include: Gas will be available and reliable through 2010. By 2010, 25% of gas produced could come from nonconventional sources. Gas-fired cooling, cogeneration, and fuel cells may make an impact on gas demand by 2010. CNG vehicles are economically viable but will have limited impact on demand unless much stricter legislation is passed.

0330 Properties

REFER ALSO TO CITATION(S) 12754

12618 **(DOE/MC/21180—2617) Gas hydrates thermomechanics: Final report.** Corlett, R.C. (USDOE Morgantown Energy Technology Center, WV; Washington Univ., Seattle (USA)). Apr 1988. Contract AC21-84MC21180. 45p. NTIS, PC A03/MF A01. Order Number DE88010280/JAW.

Solid CH_4 hydrate samples can be built up by pulses of water spray onto a solid surface in a CH_4 atmosphere at temperature and pressure within the hydrate stability domain. By pulse spraying into a cylindrical well, clean cylindrical samples approximately 4 cm diameter by 2.5 cm long can be obtained. There have been found experimentally simple means to achieve for such a cylindrical sample axial stress in excess above the radial and azimuthal stress imposed by gas pressure on the lateral face or excess radial and azimuthal stress above axial stress imposed by gas pressure on the end face. When uniaxially loaded on the end faces, the samples have very little strength, crushing or fracturing at excess axial stress less than 0.2 MPa, at temperatures above 0 deg C, but can withstand at least 2 MPa at temperatures below 0 deg C. These results suggest that stress anisotropy is not a significant factor in the thermomechanics behavior of gas hydrates at temperatures above 0 deg C. Samples can be temporarily depressurized below the stability envelope at temperatures below 0 deg C and then be repressurized and have temperature raised above 0 deg C without any change of appearance, whereas, at temperatures above 0 deg C, samples decompose and dramatically alter in appearance upon depressurization below the stability envelope. 6 refs., 10 figs.

12619 **(BG-Trans—09692) Gas calorimeters for determination of the gross calorific value.** Assenmacher, H.; Herbst, G. Translated from *GWF, das Gas- und Wasserfach: Gas/Erdgas ;* **129**: No. 7, 296-305(1988). 27p. NTIS, PC A03/MF A01 - OSTI. Order Number TI89004475/JAW.

This paper deals with the determination of the gross calorific value of gases by means of automatic gas calorimeters. The modes of operation of the gas calorimeters approved to-date by the Physikalisch-Technische Bundesanstalt (PTB) are described and the general and characteristic differences between the various types of apparatus are described. The conditions for the smooth operation of these gas calorimeters and any possible sources of errors are given. The measuring accuracy of the gas calorimeters has been examined on gross calorific value measurements obtained at different points in the pipe network of Ruhrgas AG on a given gas. Also described are the preliminary testing of the measuring parts and the certification or calibration at their places of installation. 9 refs., 15 figs.

0340 Combustion

REFER ALSO TO CITATION(S) 12614, 13044, 13092

12620 **(PB—89-129217/XAB) Ir fuel/air control for methane combustors. Final report, May 1987-May 1988.** Zabielski, M.F.; Egolf, C.J.; Hollick, H.H. (United Technologies Research Center, East Hartford, CT (USA)). 31 May 1988. 93p. (UTRC—956821-F). NTIS, PC A05/MF A01.

See also PB—87-102182.

This project was conducted to determine whether the infrared emission from natural gas flames can be used to control fuel/air ratio on industrial burners. The results from the laboratory phase of the study demonstrate that a 'hill-climbing' control based on modulated infrared emission from a fully premixed burner and employing a microprocessor can accurately regulate fuel/air ratio. Two prototype controllers were installed and operated at a pilot-scale combustion facility. A fuel-flow modulator was successfully demonstrated on both long diffusion and flat flames. Software improvements included routines to perform phase-sensitive detection and frequency matching.

12621 **(PB—89-131106/XAB) Catalytic radiant tube. Phase 2. Proof of concept. Phase 3. Catalyst and tube evaluation. Final report, February 1, 1986-April 30, 1988.** Tidball, R.K.; Donaldson, R.J.; Kennedy, J.M. (Alzeta Corp., Santa Clara, CA (USA)). Oct 1988. 93p. (ALZETA—88-722-145). NTIS, PC A05/MF A01.

See also PB—87-224820.

Phase 2, Proof of Concept, covered testing of both ceramic and metal tubes with either oxide or precious metal catalysts applied to the interior tube wall. Premixed natural gas and air was reacted at the catalyzed wall and the energy produced by combustion conducted through the tube wall and was transmitted primarily by radiation to the load. Exterior tube-wall temperatures of 2000 F were achieved and NOx emissions were less than 5 ppmv. A major problem, however, was catalyst durability. The best results were obtained with a 3/4 inch OD x 1/2 inch ID x 12 inch L silicon

carbide tube with a platinum catalyst. The tube remained radiant less than 10 hours during continuous operation. Based on the results of Phase 2 testing, Phase 3 work was directed toward improving radiant-tube longevity. Research was specifically focused on the washcoat (catalyst support) in an effort to improve catalyst life and therefore extend radiant-tube life. A zirconia washcoat was developed which has excellent stability and surface area retention at temperatures encountered in catalytic radiant tubes (1600-2200 F). The washcoat was used as a support for a platinum catalyst on both metal and ceramic tubes. Catalytic radiant tube life was significantly extended from 10 hours to nearly 1000 hours using the zirconia washcoat.

12622 **(PB—89-131114/XAB) Development of a rotary valve for pulse combustion applications. Final report, June 1986-March 1988.** George, P.E.; Corliss, J.M. (Battelle Columbus Div., OH (USA)). 31 Oct 1988. 63p. NTIS, PC A04/MF A01.

See also PB—88-250568.

Research demonstrated the technical feasibility of a computer-controlled inlet-air rotary valve for pulse-combustion applications. The results show that a Schimdt pulse combustor operated with a rotary valve provides similar performance in terms of heat transfer, pressure boost and turndown ratio to that of aero-valved and flapper-valved pulse combustors. The benefits of scale-up ease, design flexibility, and tolerance of adverse conditions do not justify the added cost of the valve, motor, and control systems for most industrial applications.

04 OIL SHALES AND TAR SANDS

0402 Site Geology And Hydrology

12623 **(DOE/LC/11086—T3) The development of the KENTORT II process for Eastern US oil shale: Technical report for the period, January 1, 1988--March 31, 1988.** Carter, S.D.; Rubel, A.M. (Kentucky Univ., Lexington (USA). Center for Applied Energy Research). Jul 1988. Contract FC21-86LC11086. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE88015508/JAW.

This report summarizes the progress made on the development of the KENTORT II process during the period of January 1, 1988 through March 31, 1988. The purpose of this program is to develop on a small scale a process to improve efficiency, process economics, and resolve environmental problems involved in the utilization of eastern US oil shale as an energy source and chemical feedstock. The process includes fluidized bed sections of pyrolysis, gasification, and combustion with combined solid/gas heat transfer among the stages. A 1.5-inch diameter bench-scale fluidized bed reactor was used to investigate the combustion behavior of raw, pyrolyzed, and pyrolyzed/gasified Eastern oil shale materials. Agglomeration of raw and pyrolyzed shales caused blockage of the product withdrawal lines and prevented extended operation of the reactor. Analysis of the agglomerates and resolution of this difficulty is pending. It was discovered, however, that the pyrolyzed/gasified shale char did not form agglomerates allowing smooth operation of the reactor. Consequently, a test matrix involving pyrolyzed/gasified shale char was initiated. Runs investigating carbon combustion at 700, 800, and 900{degree}C and 30 minutes mean solid residence time (MSRT) were completed, and under all conditions over 90% of the carbon was removed from the feedstock.

12624 **(DOE/MC/22140—2651) Geologic and engineering analyses and evaluation of factors affecting widespread development of Devonian Shale oil reservoirs: Final report.** Ferrell, H.H.; Lowry, P.H.; Kennedy, J.E.; Dauben, D.L. (K and A Technology, Tulsa, OK (USA)). May 1988. Contract AC21-86MC22140. 326p. NTIS, PC A15/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000924/JAW.

The objective of this study was an oil resource evaluation of Devonian Shale underlying a seven county area in Ohio and West Virginia near the Ohio River and the Burning Springs Anticline. This area contains about 200 square miles in which operators have drilled through or completed 2000 wells in the Devonian Shale. In spite of the high density of wells, only about four percent of the completed wells produced an excess of the 20,000 barrels needed to break even. The median production was 800 barrels and the mean was 4600 barrels. As a part of the reservoir study, data were collected from various sources, and a computer data management system was used to aid in the analysis. Engineering techniques, including material balance, a transient method for analysis of production data, and numerical simulation were employed, together with statistical methods, to complete the evaluation. These methods are believed to be applicable to other fractured tight matrix environments. Other findings of the study showed that the coexistence of natural fractures and matrix permeability and porosity are requisites for oil production from shale. These conditions are unique particularly to the lower Huron member of the Devonian Ohio Shale in and near this seven county area, but are by no means consistent over the area as evidenced by the few commercially successful wells. Matrix permeability and porosity are necessary for oil accumulation and production, because the permeability is extremely low, fractures are necessary to transmit oil from the matrix to the wellbore. 56 figs., 16 tabs.

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 12623

0404 Oil Production, Recovery, And Refining

12625 **(DOE/MC/11076—2626) Thermal decomposition of asphalt ridge tar sand: Topical report.** Turner, T.F.; Ennen, L.W. (Western Research Inst., Laramie, WY (USA)). Apr 1988. Contract FC21-86MC11076. 36p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE88010287/JAW.

Asphalt Ridge tar sand had been examined using thermal analysis techniques. These techniques include isothermal pretreating followed by thermogravimetric analysis, isothermal testing with detailed product analyses, nonisothermal testing with evolved gas analysis, and nonisothermal combustion analysis of residual carbon formed during pyrolysis. Isothermal experiments have been performed at 350{degree}, 375{degree}, and 400{degree}C (662{degree}, 707{degree}, and 752{degree}F) using a rapid heating and cooling system. Condensible products have had an average molecular weight of 276 and have shown an increased H/C ratio at higher pyrolysis temperatures. Noncondensable products have been predominantly carbon dioxide, carbon monoxide, hydrogen, and methane. The amount of heptane-soluble material has decreased with increasing conversion while the amount of pyridine-soluble material has increased. Nonisothermal experiments have indicated thermal decomposition through two major pathways. The low-temperature pathway has an activation energy below 10 kcal/mole, indicating that devolatilization might be the rate-controlling step. The high-temperature evolution pathway has a predicted activation energy of 34 kcal/mole when analyzed with a single activation energy model. Analyses of residual carbon combustion data have shown an activation energy in the range of 26--32 kcal/mole. The reaction appears to be first order in oxygen partial pressure. 12 refs., 20 figs., 10 tabs.

12626 **(DOE/MC/11076—2640) The numerical simulation of wet combustion of tar sand in a tube reactor using the asphalt ridge resource: Topical report.** Vaughn, P. (Western Research Inst., Laramie, WY (USA)). Sep 1987. Contract FC21-86MC11076. 54p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000916/JAW.

The Tar Sand Reservoir Simulator (TSRS) was enhanced and used to model the forward wet combustion of Asphalt Ridge tar sand in Western Research Institute's (WRI's) tube reactor. The enhancements made to the model account for boundary heat transfer, gravity drainage, and porosity variation with coke deposition. The model also utilizes recent data collected at WRI to more accurately describe the pyrolysis kinetics of Asphalt Ridge bitumen. The model is successfully used to simulate the forward wet combustion of Asphalt Ridge tar sand in a tube reactor. The results from simulations of two tests conducted at the injected steam:oxygen ratios of 3.1:1 and 6:1 are compared to the test re-

sults. Compared to the observed performance, the predictive simulations overestimate oil yields by 10% to 15%, overestimate frontal velocities by as much as 50%, and underestimate peak temperatures by 150{degree}F (65{degree}C). The predicted simulations also do not produce the large pressure drops which were observed throughout the tests. Post-test characterization data suggest that differences between simulated and experimental behavior result from changes in oil phase mobility during the tests which are not accounted for by the simulations. The effect of these mobility differences on combustion performance is evaluated, and the subsequent history match simulations results show improved agreement to the experiments in all areas. 17 refs., 10 figs., 7 tabs.

12627 **(DOE/MC/11076—2642) Tar sand pyrolysis with product oil recycling: Progress report.** Cha, C.Y.; Guffey, F.D.; Romanowski, L.J. (Western Research Inst., Laramie, WY (USA)). Sep 1987. Contract FC21-86MC11076. 56p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000918/JAW.

Eight tests were conducted using Asphalt Ridge tar sand to determine the effects of pyrolysis temperature and residence time on oil yield and product distribution and to produce samples for the evaluation of product oil characteristics. A 48-hour test was conducted to measure the operating time required to reach a steady state with respect to the composition of product gas and the elemental compositions of light product oil and heavy recycle oil. A 30-hour test was conducted using Sunnyside tar sand to obtain preliminary data. The product oil samples were analyzed to determine the distribution of hydrocarbon types and to relate this distribution to that typical of various fuel types. No major operational difficulties were experienced with the 2-inch screw pyrolysis reactor system. Experimental results obtained from the Asphalt Ridge and Sunnyside tar sands indicate that oil yields from the ROPE{copyright} process could be greater than yields from conventional pyrolysis processes. 3 refs., 10 figs., 41 tabs.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 12625, 12626

05 NUCLEAR FUELS

0501 Reserves, Exploration, And Mining

REFER ALSO TO CITATION(S) 12646, 12664, 12735, 13228, 13230, 13231

12628 **(CNIC—00090) Regional metallogenic essential factor of granite-type uranium deposits in Guangdong province.** Pan Yongzheng. (Bureau of Geological Prospection and Exploration of South China, Guangdong). (China Nuclear Information Centre, Beijing, BJ). Dec 1987. 16p. (In Chinese). (BGPS—0001). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705044/JAW.

The uranium origin, activation region, red basin, and fault depressed zone constitute the regional metallogenic essential factor of the four united like one granite-type uranium deposits in the post-Caledonian rise area in China. In the development of sub-geosyncline in the Caledonian, the clastic formation with widely deposited carbon, silicon, mud rich bearing organic matter, which drow a great amount of uranium formed the uranium-bearing system in the Sinian-Cambrian period. The magmagranite activation in a large scale in the Indosinian-Yenshanian period caused the continental crust to be suffered strong reformation and the uranium-bearing basement system to be eroded and remelted, and formed the rich uranium granite body. The multiple structure-magmatic movement further made the uranium in the rock body suffered the endogenic, structure, supergene active reformation, and produced mobile uranium concentrated area. Under the dry and hot paleoclimate condition in the Cretaceous-Tertiary period, strong weathering and hot water leaching forced uranium to be concentrated into the 'rock origin activation' type uranium deposits in the fault depressed zone.

12629 **(IAEA-TECDOC—471) INTURGEO: The international uranium geology information system. A world atlas of uranium occurrences and deposits.** (International Atomic Energy Agency, Vienna (Austria)). Sep 1988. 493p. NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS. Order Number DE88704956/JAW.

The International Uranium Geology Information System (INTURGEO) is an international compilation of data on uranium deposits and occurrences. The purpose of INTURGEO is to provide a clearinghouse for uranium geological information that can serve for the better understanding of the worldwide distribution of uranium occurrences and deposits. The INTURGEO system is by no means complete for all regions of the world. Data have been available principally from the WOCA countries. INTURGEO currently covers 6,089 occurrences and deposits in 96 countries of which 4,596 occurrences in 92 countries are presented here. The information presented in this publication is a very brief, one line synopsis of deposits and occurrences, and has been collected from literature and through questionnaires sent directly to IAEA Member States. None of the information contained in the INTURGEO database was derived from confidential sources although there are many entries which come from the internal files of Member States and are not directly available in the general literature. The uniformity of the INTURGEO data presented in this report has depended heavily on the data provided by Member States. Basic information includes the deposit or occurrence name, the mining district, the tectonic setting, the geological type, status, size, host-rock type, age of mineralization and bibliographic references. The data contained in the maps of the atlas include all reported occurrences of uranium above the anomaly level. The categories of occurrence and deposit status includes: Anomaly; occurrences of unknown status; occurrences; prospects; developed prospects; subeconomic deposits; economic deposits; mines; inactive mines; depleted mines. A microcomputer version of INTURGEO on 21 Megabyte Bernoulli disks is available. 5 tabs, 102 maps.

12630 (IAEA-TECDOC—472, pp 61-70) **INDUGEO - Indian uranium geological database.** Nagaraj, K.N.; Srinivasa Murthy, P.; Tewari, S.G. (Department of Atomic Energy, Hyderabad (India). Atomic Minerals Div.). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

The Atomic Minerals Division is engaged in surveying for various atomic minerals in India since 1950. During the last thirty-six years a large volume of geological, analytical, mineralogical and other relevant data have been generated and documented in a systematic manner. These data are presently available on manually operated files. This conventional way of data handling though serves a limited purpose, is very slow for information retrieval and is highly inefficient for large data volumes and multiple users. An efficient way of handling information to match the speed of data generation and demand for quick information retrieval is through a computer using a data base approach. With this objective in view, Indian Uranium Geological Data Base (INDUGEO) was designed on the lines of INTURGEO 1. The System 332 Computer where the INDUGEO has been implemented supports a network file structure. INDUGEO consists of eleven files. A base with proper logical relationships and links has been designed for easy access, quick retrieval and query. The System provides sufficient flexibility to the application programmer to change the view of the data to suit different applications. There is also provision for extending the data base to meet any future requirements. The System has been made user friendly with HELP Commands to assist those who have little programming knowledge. (author). 1 ref., 1 fig.

12631 (IAEA-TECDOC—472, pp 73-86) **Analysis of airborne gamma ray spectrometric data from the volcanic region in the eastern part of China.** Zhao Shuxin. (Ministry of Nuclear Industry, Shijiazhuang (China). Bureau of Geology). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

Airborne spectrometric data with high sensitivity from volcanic region in the eastern part of China are analyzed in this paper, some suggestions for further use of these data are made. The analysis of the relationship between geochemical fields of airborne uranium concentration and uranium deposits, investigation on uranium sources, effect of thorium concentration variation on distinguishing regional structure, petrological characteristics and potential prospecting are of specified significance for uranium exploration. Because of geological and geomorphic features, there are weak airborne anomalies in the region, at the same time, because of development of a drainage system and geochemical mobility of uranium, anomalies in the form of dispersion train of radioelement of uranium deposits are frequently found, which are important clues for uranium exploration. (author). 5 refs, 10 figs, 2 tabs.

12632 (IAEA-TECDOC—472, pp 87-116) **Data enhancement techniques for airborne gamma ray spectrometric data.** Tewari, S.G.; Nagaraja, K.N.; Surya Kumar, N.V. (Department of Atomic Energy, Hyderabad (India). Atomic Minerals Div.). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

High sensitivity airborne gamma ray spectrometric and magnetic surveys have been conducted by the Atomic Minerals Division in India since 1978. About 250,000 line kilometers of data have been obtained at 1km. line spacing in parts of Bihar, Rajasthan, Andhra Pradesh, Karnataka, Madhya Pradesh in India. The data have been processed using a library of computer programmes developed inhouse. The first step of processing consists of making contour maps for five main parameters namely eU, eTh, K, Total cps and Magnetic and three derived parameters, eU/eTh, eU/K and eTh/K. Statistically significant anomaly maps are prepared based on the information on the geological boundaries. This information is coded and written on the data tape for computing the mean and variance of each parameter namely eU, eTh and K for a given geological unit. Where geological information is lacking line anomaly maps are prepared for each flight profile based on the mean and variance of each parameter along and across the profile. These maps are prepared using a drum plotter or printer. Alphanumeric maps for each parameter are prepared by dividing the data set into three to four ranges based on the frequency distribution for that parameter. Combining the three most significant parameters namely, eU, eU/eTh and eU/K and dividing each parameter into three ranges say High, Medium and Low, twenty-seven such combinations are obtained. A unique character is printed for a specific combination of the three parameters. This is less expensive than colour coding. The exact location of zones of interest on the base map are delineated using flight line number and grid points obtained from the flight data. Three case studies characterised by their own radiometric parameters are presented using these techniques to illustrate their usefulness. 6 refs, 11 figs.

12633 (IAEA-TECDOC—472, pp 117-130) **Integration of landsat MSS imagery with aeromagnetic and airborne spectrometric data over a part of Mozambique.** Garrard, G.R. (Hunting Geology and Geophysics Ltd., Borehamwood (UK)). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

An area within the undifferentiated Precambrian gneisses and granulites of the Mozambique Belt was studied using Landsat MSS imagery, aeromagnetic data and spectrometric data. Airborne radiometric data including total count, uranium, thorium and potassium channels and aeromagnetic data were prepared as raster scanned images, which were registered and combined with the Landsat imagery on an image processing system. In addition to study of the individual data sets the spectrometric channels were manipulated to provide ratios and composite images. These composite images provided information from the three main channels, potassium, uranium and thorium. Single channel images derived from them were colour contoured and integrated with the Landsat imagery. An interpretation of the geophysical data integrated with the Landsat imagery was compared with separate interpretations of each previously carried out. The combined display techniques employed, substantially improved the discrimination of lithology within the area studied and provided a more detailed description of the regional structure. (author). 16 refs, 6 figs, 1 tab.

12634 (IAEA-TECDOC—472, pp 131-163) **Integrated remote sensing approach to uranium exploration in India.** Perumal, N.V.A.S.; Kak, S.N.; Katti, V.J. (Department of Atomic Energy, Hyderabad (India). Atomic Minerals Div.). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

Integrated data from remote sensing and other conventional geophysical methods has helped to accelerate the pace of uranium exploration in a wide variety of geological environments in India during the last two decades. The integration involves data from Landsat MSS and TM, airborne multispectral scanner, air-photos, high sensitivity airborne gamma-ray spectrometry, airborne magnetics and ground gravity surveys. Computer processing of digital Landsat MSS and airborne MSS data supplemented with data from detailed photo-interpretation and Landsat TM analysis aided selection of areas for ground surveys. This information when integrated with data on distribution of U, Th and K and U/Th, U/K and Th/K ratios obtained by airborne high sensitivity gamma ray spectrometry has helped in the precise mapping of structural lineaments, shears, thrusts, lithological units and transition zones for uranium mineralization, identification of local litho-structural controls of mineralization and location of similar litho-structural traps elsewhere. The interpretative possibilities of the remotely sensed data are greatly enhanced when synthesised with high sensitivity gamma-ray spectrometric estimations and aero-magnetic and ground gravity data. This paper presents some case histories illustrating the usefulness of integrated remote sensing approach in uranium exploration in different geological environments, such as the Dharwarian rocks in Southern India, the intra-mobile belts of migmatite-granitoid complexes traversed by major shear zones in Central India, the interfaces of Archaean cratonic regions with Proterozoic mobile belts characterised by deep crustal fractures as in Eastern India and the Tertiary Siwalik molasse deposited along the Himalayan foredeep. 15 refs, 12 figs, 3 tabs.

12635 (IAEA-TECDOC—472, pp 165-170) **Uranium exploration in the precambrian of west Greenland using integrated gamma spectrometry and drainage geochemistry.** Steenfelt, A. (Groenlands Geologiske Undersoegelse, Copenhagen (Denmark)). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

12636 (IAEA-TECDOC—472, pp 171-196) **Analysis of integrated geologic data for uranium exploration in Egypt.** Mostafa, M.E. (Nuclear Materials Corporation, Cairo (Egypt)). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

Geologic information system (GIS) related to Nuclear Raw Materials is in current development in the Scient. Inform. Dept. (NMC). Processing of data follows developed criteria in U-exploration. Landsat image interpretation, photo lineaments, field measured joints, faults, folds, foliation, lineation, and deformed pebbles when properly integrated and computerized have pointed out a comprehensive tectonic model related to the CED of Egypt. The area seemed to be subjected to three deformative stages, in the first two; rocks undergone plastic deformation, while in the third one, rocks failed in brittle mode where the Red Sea Transverse Tectonic Trend (ENE-WSW) was developed intersecting the older plastically developed linear elements (NW-SE). Further rejuvenations permit opening the mentioned fractures and occupied by siliceous materials and jasperoid veins and lastly by U-type mineralization, best depicted in the plutons of El Missikat, El Erediya, Um Had and Kab Amiri. The Oligocene Qatrani Formation, north of Lake Qarun. NWD of Egypt is a typical example of fluviatile deposits.

The middle clayey member is enclosed between two porous sandy members. The carbonaceous shale related to the clayey member shows abnormal U-concentrations. Statistical analysis of the distribution of uranium and other trace elements in the carbonaceous shale shows that U, Y, Mn and Ca obey the lognormal law while Sr, Rb, Zr, Cr and Ti obey the normal law. A geologic factor is derived that normally distributed elements are stationary, indigenous probably of detrital origin. Meanwhile, other lognormally distributed elements are active and mobile. Subsurface mapping shows that uranium tends to concentrate in the troughs of the flexured carbonaceous shale suggesting an epigenetic origin. 14 refs, 9 figs, 4 tabs.

12637 (IAEA-TECDOC—472, pp 197-217) **Anorthosite related polymetallic thorium-uranium deposits in the Namaqualand Metamorphic Complex, South Africa.** Andreoli, M.A.G.; Andersen, N.J.B.; Faurie, J.N. (Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

Since 1980 detailed geological, geophysical and geochemical investigations have been carried out in the Namaqualand Metamorphic Complex of South Africa in the search for a suitable site for the disposal of low- and intermediate-level radioactive waste. The Vaalputs site, which was ultimately selected is located 100 km south of the town of Springbok in the northwestern Cape. During the investigation, detailed geological mapping as well as airborne radiometric and magnetic surveys were conducted. The anomalies located by the airborne surveys were followed up on the ground by geophysical surveys and by further mapping and drilling. The airborne surveys indicated that the basic and anorthositic intrusives gave clear radiometric and magnetic anomalies. The syntectonic granite gneisses also proved to contain anomalous concentrations of uranium and thorium. The trend of these radiometric anomalies follows the regional distribution pattern of the intrusive anorthosites. The anorthosite-enderbite intrusives in the Vaalputs area are compared with those found in "steep structures" in the Okiep and Steenkampskraal districts and a north-south metallogenic zoning is proposed. (author). 19 refs, 4 figs, 5 tabs.

12638 (IAEA-TECDOC—472, pp 219-237) **Application of the geostatistical analyses to uranium geology. Ore reserve estimation and interpretation of airborne magnetic survey data.** Tang Shenghuan; Xue Yuxuan; Meng Jinqing. (Ministry of Nuclear Industry, Beijing (China). Bureau of Geology). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

A method for treating the uranium geological data of different types using geostatistical analyses (kriging analysis and/or factor kriging analysis) is described in the paper. The original data are stored in the data bank and can be taken out for analysis. The uranium reserves are estimated by kriging analysis. A complete system of programs suitable for uranium reserve estimation is developed, beginning with input of original gamma-logging data in order to transfer them into ore grades in computer and to calculate uranium grade variograms and, then, to estimate uranium reserves. A case example is presented. In order to develop a new method of analysis for regional geophysical and geochemical data processing, the factor kriging analysis in combination with the essential ideas of kriging analysis and principle component analysis is used. This method enables the regionalized variables to split into the components of different frequency intervals corresponding to different ranges, and then, on the basis of major component analysis several (usually two) major ranges are determined in order to infer the geological structure related to these major ranges. According to the formula of magnetic frequency spectrum and by using fourier inverse transform of 2-dimension, covariance function and variogram are derived. The preliminary results obtained by treatment and analysis of a large number of airborne magnetic data using factor kriging analysis are given. (author). 4 refs, 7 figs.

12639 (IAEA-TECDOC—472, pp 239-242) **Interpretation of airborne radiometric data to predict the occurrence of uranium.** Talvitie, J.; Arkimaa, H.M.; Aeikaes, O. (Geologinen Tutkimuslaitos, Espoo (Finland); Geological Survey of Finland, Kuopio (Finland)). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

Uranium pegmatites and associated uneconomic uranium mineralizations have been found in Central and Southern Finland in connection with granitoid rocks and migmatites. Because of the glaciated terrain, where only three per cent of the bedrock area is exposed, the variation in radiation intensities reflects the variation in the thickness of the overburden, in its moisture content and in the ground-water level. When the ratios of different energy levels of radiation are used, "the fingerprint ratio" for a certain type of uranium deposit can be found. (author). 3 refs, 1 fig.

12640 (IAEA-TECDOC—472, pp 273-302) **Geohydrology and its application in defining uranium and other metallogenic provinces.** Levin, M.; Camisani-Calzolari, F.A.G.M.; Hambleton-Jones, B.B. (Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

In South Africa, ground water samples are collected regularly from existing and newly drilled boreholes during the evaluation and development of ground water resources for domestic, agricultural, mining, radioactive waste disposal and industrial purposes. About 8,200 ground water samples have been analysed routinely for the major components as well as for uranium but on certain samples trace metals have also been determined. Three major zones have emerged, concentrated mainly in the northern and northwestern Cape Province, with several minor ones scattered elsewhere in the country. In certain instances, the anomalies coincide with known uranium occurrences in a variety of geological environments like granitic and ultrabasic rocks of the Namaqualand Metamorphic Complex, sandstones and tillites of the Karoo Sequence and surficial deposits of Upper Tertiary Kalahari age. During the site selection phase of the radioactive waste disposal project approximately 850 ground water samples were collected in a 30,000 km/sup 2/ region of the semi-arid northwestern Cape. The purpose of this investigation was to attempt to delineate potential mineral occurrences such as base metals and uranium that are covered by a veneer of surficial material. Up to 34 variables were analysed for each sample, all of which were geostatistically kriged. The data showed a poor correspondence between ground water anomalies and base-metal and uranium occurrences but nevertheless metallogenic subprovinces or zones could be identified within these large areas for future target selection. It is further concluded that the methods used demonstrated that potential source and host rocks under thick non-uraniferous surficial cover could be outlined. In leached areas, where surface sampling has failed to detect uranium occurrences, this approach was successful. 14 refs, 18 figs.

12641 (IAEA-TECDOC—472, pp 303-338) **Interpretation and evaluation of regional geochemical anomalies of uranium.** Frick, C.; Strauss, S.W. (Geological Survey of South Africa, Pretoria (South Africa)). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

In arid terrains where physical weathering predominates regional geochemical stream sediment maps generally reflect the chemical composition of the bedrocks. During the present investigation five regional uranium anomalies were studied using a multivariate regression technique in order to develop criteria whereby the potential economic significance of these regional anomalies can be evaluated. The anomalies studied were identified on the basis of U grey scale maps and four of them are located on intrusive granite plutons in the Northwestern Cape Province. The remaining anomaly occurs on a sequence of sediments with a provenance of a U-rich

granite. Uranium can be concentrated in accessory minerals such as monazite, apatite, sphene and zircon, or it could be hosted in uraninite and thorianite. Anomalies resulting from the latter minerals are presently the most attractive exploration targets. During the stepwise multivariate regression study a total of 20 elements were regressed against U, and the elements which yielded the most significant regression coefficients were identified and ascribed to specific mineral phases. It was possible to show that 80 to 90 percent of the uranium present in three of the intrusive plutons could be accounted for by U hosted in zircon, sphene, iron oxides and biotite, and consequently only a small U-residual results. In the fourth pluton, however, it was possible to show that only 10 percent of the U can be accounted for by U hosted in fluorite and iron oxides. Stepwise multivariate regression showed that 90 percent of the U in the Schwarzrand basin is hosted either in zircon or calcite, thus causing this regional anomaly to be unattractive. A fission tract study of the stream sediment samples showed that the mineralogical constraints established during the stepwise multivariate regression are valid. (Abstract Truncated)

12642 **(INIS-mf—11335) Uranium in Nova Scotia: a background summary for the uranium inquiry, Nova Scotia.** (Nova Scotia Dept. of Mines and Energy, Halifax (Canada)). 1982. 112p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705192/JAW.

Report--82-7.

Since the mid 1970's Nova Scotia has experienced increased exploration for a number of commodities including uranium. The exploration activity for uranium has resulted in discovery of significant occurrences of the element. It became obvious to the Government of Nova Scotia that a segment of the population of the Province is concerned about the potential hazards associated with the exploration, mining and milling stages of the uranium industry. Public concern has resulted in the appointment of a Commissioner under the Public Inquiries Act of Nova Scotia to inquire and make recommendations to the Governor-in-Council on all aspects of exploration, development, mining, processing, storage, waste management and transportation of uranium in any form. The regulation of mineral exploration and mining activities is carried out by the Nova Scotia Department of Mines and Energy through the Mineral Resources Act of the Province of Nova Scotia. The regulation of the special radioactive aspects involved in the mining and processing of uranium ore is the responsibility of the federal Atomic Energy Control Board. The purposes of this report is to: outline the history of uranium exploration in Nova Scotia; summarize the results of geological surveys by provincial and federal government agencies, universities and exploration companies which document the natural levels of radioactivity in the Province; briefly outline the physical and chemical characteristics of uranium and thorium which make these elements unique and a potential environmental and health concern; outline chronologically the steps taken by the Nova Scotia Department of Mines and Energy to monitor and regulate uranium exploration activities; classify the types of uranium deposits known to occur in Nova Scotia and describe their main geological features; outline the role of the Nova Scotia Department of Mines and Energy in the regulation of mining activities in the Province. (Abstract Truncated)

0504 Feed Processing

REFER ALSO TO CITATION(S) 12666, 13232, 13236

12643 **(CNIC—00058) Decomposition and reduction of AUC in hydrogen.** Ge Qingren; Kang Shifang; Zhou Meng. (Tianjin Univ. (China)). (China Nuclear Information Centre, Beijing, BJ). 1987. 10p. (In Chinese). (TU—0004). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705026/JAW.

AUC (Ammonium Uranyl Carbonate) conversion processes have been adopted extensively in nuclear fuel cycle. The kinetics investigation of these processes, however, has not yet been reported in detail at the published literatures. In the present work, the decomposition kinetics of AUC in hydrogen has been determined by non-isothermal method. DSC curves are solved with computer by Ge Qingren method. The results show that the kinetics obeys Avrami-Erofeev equation within 90% conversion. The apparent activation energy and preexponent are found to be 113.0 kJ/mol and 7.11 x 10/sup 11/ s/sup -1/ respectively. The reduction kinetics of AUC decomposition product in hydrogen at the range of 450 - 600 deg C has been determined by isothermal thermogravimetric method. The results show that good linear relationship can be obtained from the plot of conversion vs time, and that the apparent activation energy is found to be 113.9 kJ/mol. The effects of particle size and partial pressure of hydrogen are examined in reduction of AUC decomposition product. The reduction mechanism and the structure of particle are discussed according to the kinetics behaviour and SEM (scanning electron microscope) photograph.

12644 **(CNIC—00074) Investigation on preparation of uranium tetrachloride from chlorinating uranium dioxide by carbon tetrachloride and its mixing reagents.** Qiu Lufu; Xu Heqing; Zhao Jun. (Tianjin Univ. (China)). (China Nuclear Information Centre, Beijing, BJ). Sep 1987. 12p. (In Chinese). (TU—0007). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705032/JAW.

By studying the change of the temperature for gaseous space and solid layer within the reactor and improving structure of reactor and types of feed material stocked in the boat pan, it is possible to reduce the volatilization loss of uranium, allowing the uranium yield to rise above 97%. A further study found that chlorination of UO/sub 2/ by using a mixture of CHCl/sub 3/ + CCl/sub 4/ can markedly reduce the volatilization loss of uranium chlorides, and the uranium yield is above 99%. The content of free carbon is less than 100 ppM in the product. A new chlorination process has been developed.

12645 **(CNIC—00104) Leaching study of sedimentary-uranium deposit ore samples with individual lithological character.** Li Yannan; Jiang Dabin; Liu Guohong; Han Hengming; Zeng Wanxing; Ma Minghuang; Li Zicheng. (Ministry of Nuclear Industry, Beijing, BJ (China). Research Inst. of Uranium Ore Processing). (China Nuclear Information Centre, Beijing, BJ). Nov 1987. 11p. (In Chinese). (BRIUOP—0004). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705046/JAW.

The leaching behaviors of four kinds of ore samples with individual lithological character were investigated. The four kinds of ore samples are: (1) tuffaceous conglomerate containing organic matters; (2) tuffaceous sandstone with gravel; (3) pelitic siltstone; (4) tuff. The sanning electron microprobe, in combination with X-ray diffraction, provides an efficient means for sample analyses. The leaching condition used are: liquid/solid ratio, 1:1; temprature, 60 deg C; leaching time, 3 hours; ore grain size, 32 mesh; additive quantity of NaClO/sub 3/, 0.3%; leaching solvent, H/sub 2/SO/sub 4/. A series of experiments show that the leaching rate of U for the first three samples is approximately 90% when acid quantities used are 12%, 12%, and 8% respectively; but for tuff, only 60% with 6% of acid. By fine grinding or using nitric acid as solvent, the leaching rate of U may be increased. Increasing the residual acid concentration of leaching solution, the U containts in the leached slags of the first three samples decrease, but no effect to the tuff. The experiments indicate that the major acid consumming minerals in the four sample are carbonates of calcite and dolomite, etc., but such minerals in tuff is much less.

12646 **(CONF-8704115—Summ.) Remedial action programs annual meeting: Meeting notes.** (UNC Geotech, Grand Junction, CO (USA); USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Remedial Action and Waste Technology). 1987. Contract AC07-86ID12584. 244p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002318/JAW.

From Remedial Action Program annual meeting; Grand Junction, CO, USA (27 Apr 1987).

The US Department of Energy Grand Junction Projects Office was pleased to host the 1987 Remedial Action programs Annual Meeting and herein presents notes from that meeting as prepared (on relatively short notice) by participants. These notes are a summary of the information derived from the workshops, case studies, and ad hoc committee reports rather than formal proceedings. The order of the materials in this report follows the actual sequence of presentations during the annual meeting.

12647 **(PAEC(B)IB—87001) Notes on the extraction of uranium from phosphoric acid. Part I.** Petrache, C.A.; Marcelo, E.; Santos, G. Jr. (Philippine Atomic Energy Commission, Diliman, Quezon City). (Philippine Atomic Energy Commission, Diliman, Quezon City). Feb 1987. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705214/JAW.

Experimental work on uranium recovery has been carried out at the Philippine Atomic Energy Commission (PAEC) on phosphoric acid samples obtained from the Philippine Phosphate Fertilizer Corporation (Philphos). In this study, uranium recovery efficiency of the first cycle solvent extraction and of the first cycle stripping has been investigated on a laboratory scale using the DEPA-TOPO process developed at the Oak Ridge National Laboratory (ORNL). Details of the work undertaken and results obtained are discussed. (Auth.). 1 fig.; 2 tabs.

0505 Uranium Enrichment

12648 **(DOE/DP—0060-Rev.) Nulcear materials production: Primer.** (USDOE Assistant Secretary for Defense Programs, Washington, DC. Office of Nuclear Materials Production). Sep 1988. 47p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006192/JAW.

The US Department of Energy's (DOE's) Office of Nuclear Materials Production (NMP) is responsible for managing the production and recovery of nuclear materials for national defense. NMP oversees the production of radioactive materials for government, commercial, industrial, and medical applications. This Primer is a general introduction to NMP's major activities.

12649 **(DOE/ID—10197-Vol.6) Report of public hearings on the draft environmental impact statement, DOE/EIS-0136: Special Isotope Separation Project: Volume 6, Proceedings of the meeting held March 26, 1989, at Boise City Hall, City Council Chambers, Boise, ID.** (Idaho National Engineering Lab., Idaho Falls (USA)). Apr 1988. Contract AC07-76ID01570. 176p. (CONF-8803145—Vol.6). NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88016932/JAW.

From Public meetings on the draft environmental impact statement-DOE/EIS-0136; Idaho Falls, ID, USA (25 Mar 1988).

This document describes public hearings held to receive comment on the Draft Environmental Impact Statement for the proposed siting, construction, and operation by the Department of Energy of a Special Isotope Separation Project utilizing the Atomic Vapor Laser Isotope Separation Process Technology (SIS Project). All interested organizations and individuals may comment on the DEIS. The Department's proposes to site, construct, and operate an SIS facility either at the DOE's Idaho National Engineering Laboratory near Idaho Falls; the DOE's Hanford Reservation near Richland, Washington; or, the DOE's Savannah River Plant near Aiken, South Carolina. Each of these three sites is designated as an alternative that is considered in the Draft EIS. The fourth and final alternative under consideration in the DEIS is the No Action Alternative.

12650 **Apparatus to recover tritium from tritiated molecules.** Swansiger, W.A. (to Dept. of Energy, Washington, DC). US Patent 4,762,685. 9 Aug 1988. Filed date 15 Oct 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an apparatus for recovering tritium from tritiated water and tritiated species such as methane and ammonia and the like, comprising: (a) reactor means having a reactor chamber charged with a mixture of uranium and a first inert substance. The mixture for decomposing an injected steam mixture to recover tritium therefrom via an exothermic reaction of the uranium with the steam, the reaction inducing temperatures in the reaction chamber in excess of the melting of uranium, the reactor means including an outer vessel having wall means establishing the reaction chamber within the vessel. The wall means being formed of material that prevents a reaction between the outer vessel with uranium, the inert substance being a refractory material and the outer vessel being of sufficient thickness to conduct heat at heat transfer rates sufficient to prevent the wall means and vessel from attaining center line temperatures prevailing in the reaction chamber; (b) preheating means connected to the reactor means for receiving a supply of tritiated water for preheating the tritiated water to temperatures of about 600°C; and (c) receiving means connected to the reaction chamber for receiving tritium from the reaction chamber.

12651 **(K/TR—88/6) 1987 Financial statement of Uranit GmbH, January 1, 1987--December 31, 1987.** (Uran-Isotopentrennungs-G.m.b.H. (URANIT), Juelich (Germany, F.R.)). 30 Jun 1988. Contract AC05-84OT21400. Translation source information not available. 62p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004474/JAW.

The report covers many facets of management of Uranit Gmbh from January 1, 1987 to December 31, 1987. Uranit Gmbh, located in Juelich, West Germany, specializes in research and development of the centrifuge process for uranium enrichment and supplies nuclear power plants with enriched uranium. The report details its business activities, research and development activities, investments, profits, and employees. 17 figs., 19 tabs. (TC)

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 12648, 12836, 12874, 12900, 13229, 13262, 13272, 13464

12652 **(Y—2399) Monitoring of interfacial tensions by drop counting.** Duerksen, W.K.; Boring, C.P.; McLaughlin, J.F.; Harless, D.P. (Oak Ridge Y-12 Plant, TN (USA)). Nov 1988. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005305/JAW.

A capillary tube device was shown to provide a rapid means of measuring the interfacial tension between water and Freon-113. The measurement technique is based on counting the number of drops that form when a fixed volume of water passes through the capillary tube into the bulk Freon. The interfacial tension is predicted to be proportional to the number of drops to the negative 2/3 power. Calibration curves were obtained for Freon-water samples containing known concentrations of a surfactant. A standard Gibbs adsorption curve was obtained. 5 refs., 3 figs., 2 tabs.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 12648, 12652, 12743, 13300

12653 **(CEA-R—5471) Spectrophotometric determination of neptunium. Development of simplify procedure for the obtention of Np(V).** Wagner, J.F. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 47p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756662/JAW.

This report describes a new method for the spectrophotometric determination of neptunium. Stabilization of neptunium (V) is obtained with the oxydation-reduction pair, vanadium (V)/vanadium(IV). Best operating conditions are obtained with ratio V (V)/V(IV) equal to 0.5. So plutonium is at the IV oxydation state and is no more interfering. Influence of different parameters of the method are overviewed. By using 1 cm length cell neptunium was determined at concentration ranging from 2 mgl/sup -1/ to 1gl/sup -1/ in the cell. This method is easy to handle, so an automatization can be expected oxidation.

12654 **(INIS-BR—1372) Flowchart evaluations of irradiated fuel treatment process of low burnup thorium.** Linardi, M. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. Tecnologico de Aeronautica). 1987. 111p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705168/JAW.

A literature survey has been carried out on some versions of the acid-thorex process. Flowsheets of the different parts of the process were evaluated with mixer-settlers experiments. A low burnup thorium fuel (mass ratio Th/U{similar←to}100/1), pro-

posed for the Brazilian fast breeder reactor initial program, was considered. The behaviour of some fission products was studied by irradiated tracer techniques. Modifications in some of the process parameters were necessary to achieve low losses of /sup 233/U and /sup 232/U and /sup 232/Th. A modified acid-thorex process flowsheet, evaluated in a complete operational cycle, for the treatment of low burnup thorium fuels, is presented. High decontamination factors of thorium in uranium, with reasonable decontamination of uranium in thorium, were achieved.

12655 **(ND-R—1538(D)) Method for the determination of free nitric acid in aqueous plutonium nitrate solutions - potassium fluoride method.** Mair, M.A. (UKAEA Dounreay Nuclear Power Development Establishment). (UKAEA Northern Research Labs., Risley (UK)). Jun 1988. 6p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705387/JAW.

Plutonium IV and VI, and certain other hydrolysable metals which may be present, are converted to non-interfering species by the addition of the sample to potassium fluoride solution. The free acid is then titrated with standard sodium hydroxide solution using phenolphthalein as an indicator.

12656 **(PNL-TR—472) The chemistry of technetium under PUREX process conditions.** Boukis, N. (Pacific Northwest Lab., Richland, WA (USA)). 28 Nov 1988. Contract AC06-76RL01830. Translation of report KfK 4362. 166p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004743/JAW.

The behavior of the element technetium in the PUREX process has been investigated. Pertechnetate ion is reduced to tetravalent technetium, TcO^{2+}, by hydrazine and acidic aqueous solution. After the nearly quantitative reduction of Tc(VII) a complicated oxidation of the hydrazine begins, accompanied by the slow re-oxidation of the tetravalent technetium to TcO_4/sup {minus}/. A large amount of tetravalent technetium remains stable in the acidic solutions for several years. Tc(IV) forms stable complexes with dibutylphosphoric acid, which are extractable with HDBP and TBP. The TcO^{2+} ion was identified by absorption spectroscopy and EPR techniques. It behavior was studied under experimental conditions of the PUREX process. Engineering experiments in the LABEX installations were performed, and the behavior of technetium in the "A" and "B" batteries was investigated. It has been shown that in a 16-step battery, an amount of technetium up to 14% (depending on the experimental conditions used) follows the plutonium fraction. 133 refs., 53 figs., 8 tabs.

12657 **(Dounreay-Trans—1012) Method of suppressing ruthenium evaporation from nitric acid solution.** Muromura, T.; Sato, T. (UKAEA Dounreay Nuclear Power Development Establishment). Jan 1988. Translation of Japanese Patent No. 62-113708. 12p. NTIS (US Sales Only), PC A03 - OSTI. Order Number DE89004511/JAW.

The invention comprises a method whereby, when a nitric acid solution wherein is dissolved ruthenium 7 {times} 10/sup {minus}5/ to 5 {times} 10/sup {minus}2/ mol/litre (0.007 g/l to 5 g/l) is heated to concentrate the ruthenium or nitric acid, the evaporation loss of ruthenium is suppressed by adding and dissolving soluble metallic iron or iron compounds in the said nitric acid solution to adjust the initial iron concentration in the said nitric acid solution to 0.01 to 1.0 mol/litre (0.56 to 56 g/l). 3 figs.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 12724, 13294, 13306, 13307

12658 **(DOE/RW—0218) Implementation plan for deployment of Federal Interim Storage facilities for commercial spent nuclear fuel.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Jan 1989. 21p. H; GPO Dep. Order Number DE89006386/JAW.

This document is the sixth annual report on plans for providing FIS capacity. References are made to the first, second, third, fourth, and fifth annual reports, as necessary. Background factors and aspects that were considered in the development of this deployment plan and activities and interactions considered to be required to implement an FIS program are discussed. A generic description of the approach that the Department plans to follow in deploying FIS facilities is also described. 21 refs., 1 fig., 1 tab.

12659 **(INIS-GB—167) Basic facts about the transport of packaged radioactive products.** (Amersham International Ltd. (UK)). Sep 1987. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756022/JAW.

The pamphlet on the "basic facts about the transport of packaged radioactive products" was prepared by Amersham International for the Advisory Committee on the Safe Transport of Radioactive Material. Details of the regulations that apply to transport, the handling of radioactive materials and the precautions to be taken are all outlined, along with what should be done if a package of radioactive materials is damaged and how packages of radioactive materials can be recognised.

12660 **(PNL—6639) DATING: A computer code for determining allowable temperatures for dry storage of spent fuel in inert and nitrogen gases.** Simonen, E.P.; Gilbert, E.R. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 72p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005970/JAW.

The DATING (Determining Allowable Temperatures in Inert and Nitrogen Gases) code can be used to calculate allowable initial temperatures for dry storage of light-water-reactor spent fuel. The calculations are based on the life fraction rule using both measured data and mechanistic equations as reported by Chin et al. (1986). The code is written in FORTRAN and utilizes an efficient numerical integration method for rapid calculations on IBM-compatible personal computers. This report documents the technical basis for the DATING calculations, describes the computational method and code statements, and includes a user's guide with examples. The software for the DATING code is available through the National Energy Software Center operated by Argonne National Laboratory, Argonne, Illinois 60439. 5 refs., 8 figs., 5 tabs.

12661 **Dry rod consolidation advancements in the OCRWM programs.** Fisher, M.W. (U.S. Dept. of Energy, Idaho Operations Office, Idaho Falls, ID (US));. *JNMM;* **16**: No. 3, 15-18(Apr 1988).

Repackaging techniques for geological disposal of spent fuel are being investigated by the Idaho Operations Office of the U.S. Department of Energy. To start this program, the Idaho National Engineering Laboratory constructed remotely operated equipment to pull rods from assemblies and stack them horizontally in new containers. Forty-eight PWR assemblies were compacted in 1987. The data on rod pulling forces, external contamination, etc. are summarized. Five companies have submitted preliminary designs for prototype production systems. Three have been selected to complete these designs. One or two of the latter will be constructed and thoroughly tested in the next few years.

12662 **DOE procurement activities for spent fuel shipping casks.** Callaghan, E.F.; Lake, W.H. (Office of Civilian Radioactive Waste Management, United States Dept. of Energy, Washington, DC (US));. *JNMM;* **16**: No. 3, 24-26(Apr 1988).

This paper discusses the DOE cask development program established to satisfy the requirements of the NWPA. The program is designed to provide safe efficient casks on a timely schedule. The casks will be certified by the NRC in compliance with the 1987 amendment to NWPA. Private industry will be used to the maximum extent. DOE will encourage use of present cask technology, but will not hesitate to advance the state-of-the-art to improve efficiency in transport operations, provided that safety is not compromised. DOE will support the contractor's efforts to advance the state-of-the-art by maintaining a technical development effort that will respond to the common needs of all the contractors. DOE and the cask contractors will develop comprehensive and well integrated programs of test and analysis for cask certification. Finally, the DOE will monitor the cask development program within a system that fosters early identification of improvement opportunities as

well as potential problems, and is sufficiently flexible to respond quickly yet rationally to assure a fully successful program.

12663 **Summary of international activities in spent fuel storage.** Shelor, D.E. (U.S. Dept. of Energy (US)); Whittington, W. (Williams Brothers Engineering Co., Washington, DC);. *JNMM;* **16**: No. 3, 38-40(Apr 1988).

In 1986, nuclear power electrical generating systems in operation worldwide numbered 397 with a combined net capacity of 273 Gigawatts electric (GWe). This net production resulted in approximately 39 thousand metric tonnes of Initial Heavy Metal being discharged as spent fuel from these systems. The storage requirements for spent fuel discharged differ in each nation and are dependent on national strategies for fuel cycle management. The design of spent fuel storage facilities is a function of the type of nuclear electrical generating system adopted, and, therefore, the spent fuel characteristics. This paper summarizes the current international status of spent-fuel storage strategies.

0510 Marketing, Economics, And By-products

REFER ALSO TO CITATION(S) 12651, 12725

12664 **(DOE/EIA--0477(87)) Domestic uranium mining and milling industry, 1987: Viability assessment.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 2 Dec 1988. 113p. NTIS, PC A06/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89005521/JAW.

This report presents the fifth annual assessment of the domestic uranium mining and milling industry's resource capability, supply response capability, financial capability, and import commitment dependency. The data and analysis in support of this assessment and the report itself have been developed pursuant to Public Law 97-415, the Nuclear Regulatory Commission (NRC) Authorization Act of 1982. The report provides information on recent uranium supply, demand, and marketing conditions, as well as projections of the domestic uranium industry's ability to continue to supply the needs of the domestic nuclear power industry through the year 2005. Industry capability is assessed under a variety of assumed conditions with respect to hypothetical disruptions of uranium imports. 13 refs., 26 figs., 37 tabs.

12665 **(DOE/OR/21400—H11) Documentation of the Uranium Market Model (UMM).** (Oak Ridge National Lab., TN (USA)). [1989]. Contract AC05-84OR21400. 100p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005860/JAW.

The Uranium Market Model is used to make projections of activity in the US uranium mining and milling industry. The primary data sources were EIA, the Nuclear Assurance Corporation, and, to a lesser extent, Nuexco and Nuclear Resources International. The Uranium Market Model is a microeconomic simulation model in which uranium supplied by the mining and milling industry is provided to meet the demand for uranium by electric utilities with nuclear power plants. Uranium is measured on a U_3O_8 (uranium oxide) equivalent basis. The model considers every major production center and utility on a worldwide basis (with Centrally Planned Economies considered in a limited way), and makes annual projections for each major uranium production and consumption region in the world. Typically, nine regions are used: the United States, Canada, Australia, South Africa, Other Africa, Europe, Latin America, the Far East, and Other. Production centers and utilities are identified as being in one of these regions. In general, the model can accommodate any user-provided set of regional definitions and data.

12666 **(INFO—0198) Cost of decommissioning uranium mill tailings.** Lush, D.L.; Lendrum, C.; Hostovsky, C.; Eedy, W.; Ashbrook, A. (Beak Consultants Ltd., Toronto, Ontario (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Apr 1986. 99p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705122/JAW.

This report identifies several key operations that are commonly carried out during decommissioning of tailings areas in the Canadian environment. These operations are unit costed for a generic site to provide a base reference case. The unit costs have also been scaled to the quantities required for the decommissioning of four Canadian sites and these scaled quantities compared with site-specific engineering cost estimates and actual costs incurred in carrying out the decommissioning activities. Variances in costing are discussed. The report also recommends a generic monitoring regime upon which both short- and longer-term environmental monitoring costs are calculated. Although every site must be addressed as a site-specific case, and monitoring programs must be tailored to fit a specific site, it would appear that for the conventional decommissioning and monitoring practices that have been employed to date, costs can be reasonably estimated when site-specific conditions are taken into account.

0520 Waste Management

REFER ALSO TO CITATION(S) 12637, 12661, 12731, 12734, 12897, 13306, 13307, 13360, 13427, 13589, 13652, 13902, 13904, 14073

12667 **(AECL—9059) Short-term dissolution experiments on various cement formulations in standard Canadian shield saline solution in the presence of clay.** Heimann, R.B.; Stanchell, M.A.T.; Hooton, R.D. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment; Ontario Hydro Research Lab., Toronto (Canada)). (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Dec 1986. 81p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88704981/JAW.

A commercially available sulphate-resisting portland cement (SRPC) and three cement formulations derived from it by adding 10 and 20 vol% silica fume or 35 vol% fly-ash have been leached in Standard Canadian Shield Saline Solution (SCSSS) with added calcium-montmorillonite or sodium-montmorillonite at 150 degrees C for 14 days. The leach solutions have been analyzed by atomic absorption spectroscopy for silicon, magensium, iron and potassium, and by inductively coupled plasma spectrometry for aluminum and phosphorous. The surfaces of the leached samples have been investigated by scanning electron microscopy in conjunction with energy-dispersive X-ray spectroscopy, and by X-ray powder diffraction methods. Cumulative pore size distrubtion curves have been recorded for as-cured and leached cement samples. It has been shown that the presence of clay accelerates the rate of dissolution of the various cements, and that the pH of the leaching solutions plays a dominant role in the elemental release kinetics.

12668 **(AERE-R—12329) Further investigations of the properties of polymer modified cements for use in the immobilisation of ILW.** Johnson, D.I. (UKAEA Harwell Lab. Materials Development Div.). Sep 1988. 47p. H.M. Stationery Office, London, price Pound 10.00.

The systems investigated were epoxide resin systems, styrene-butadiene latex, acrylic latex systems and acrylic resin systems. All the samples were mixed with OPC or BFS cement by a procedure which ensured a reproducible mixing cycle. All samples were given a 28 day cure at 20/sup 0/C under controlled humidity conditions. Samples were then tested for flexural strength and permeability (water transmission, water uptake and desorption, caesium permeation). The microstructure of the samples was then studied by optical microscopy and back scattered electron imaging. The results are presented and discussed. The principal conclusions are summarised. (U.K.).

12669 **(ANL/EES-TM—360) Transportation infrastructure between nuclear power plant gates and nearest line-haul networks: Plan and procedure for data development.** Saricks, C.L.; Singh, M.K.; Stammer, R.E. Jr. (Argonne National Lab., IL (USA)). Jun 1988. Contract W-31109-ENG-38. 42p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005994/JAW.

This study is concerned with the segments of the transportation system that include possible routings over public roads and private (or public) rail links, and waterway access (within 25 miles) from the gates of typical reactor sites to proximate links of what

can be termed the national through-route system. These routings are by no means uniform throughout the United States. Local roads and rail links near reactor sites may be subject to a wide variety of jurisdictions for maintenance, repair, and inspection; may or may not (at present) qualify for federal assistance under the Federal-Aid Highway and related funding programs; may or may not meet accepted construction standards for facilities expected to bear heavy loads; and, perhaps most importantly for the spent-fuel transportation program, may be subject to occasional and currently unavoidable disruptions that could seriously impair shipment schedules. The overall objectives of the study are to describe a framework for identifying the characteristics of the near-site transportation networks of all existing nuclear power plants that could give rise to important shipment scheduling and programming constraints. These characteristics cover both transportation infrastructure and existing structural and environmental limitation, and define a scope and schedule for constructing a data base for the transportation networks surrounding all nuclear power plants. 6 refs., 4 figs., 8 tabs.

12670 **(BMI/ONWI/C—266) Solubilities and speciation of radionuclides in brines: Technical program plan, Fiscal years 1988, 1989: Revised.** Bucher, J.; Edelstein, N. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Lawrence Berkeley Lab., CA (USA)). 26 Jun 1987. Contract AC02-87CH10290. 26p. H. Order Number TI89000069/JAW.

The objective of this program is to identify and obtain appropriate thermodynamic testing data on the solubilities of compounds and on the solution complexes of important waste radionuclides which are likely to form in the salt repository. Information on the chemical behavior of the waste radionuclides is important for site selection and characterization, and is necessary for demonstrating that the expected performance of the repository site will be in compliance with technical criteria stated in 10CFR60. Basic thermodynamic test data will be obtained on the nature and solubilities of specific compounds in brines, and on the formation constants of specific solution complexes for the waste radionuclides which are pertinent to salt repositories. Such information is needed for the thermodynamic data base to be used in predictive geochemical models and for the interpretation of site specific measurements. Although data could be obtained with salt cores for specific sites, there is a very wide variation in the components of various salt cores even from the same site. Thus, from such measurements it is impossible to determine the important factors affecting the solubilities and speciation of the radionuclides. However by the use of synthetic brine solutions, where all the components are known and controlled, it is possible to determine for experimental measurements the important components which control the solubilities and transport of the key radionuclides. Such data can then be used for predictive modeling of radionuclide solubility and transport under repository conditions.

12671 **(BMI/ONWI/C—293(3)) Documentation for grants equal to tax model: Volume 3, Source code.** Boryczka, M.K. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jan 1986. Contract AC02-87CH10290. 267p. H. Order Number TI89000295/JAW.

The GETT model is capable of forecasting the amount of tax liability associated with all property owned and all activities undertaken by the US Department of Energy (DOE) in site characterization and repository development. The GETT program is a user-friendly, menu-driven model developed using dBASE III{trademark}, a relational data base management system. The data base for GETT consists primarily of eight separate dBASE III{trademark} files corresponding to each of the eight taxes (real property, personal property, corporate income, franchise, sales, use, severance, and excise) levied by State and local jurisdictions on business property and activity. Additional smaller files help to control model inputs and reporting options. Volume 3 of the GETT model documentation is the source code. The code is arranged primarily by the eight tax types. Other code files include those for JURISDICTION, SIMULATION, VALIDATION, TAXES, CHANGES, REPORTS, GILOT, and GETT. The code has been verified through hand calculations.

12672 **(BMI/ONWI/C—298) Orientation of hydraulic fractures in SALT under hydrostatic and non-hydrostatic stresses.** Doe, T.W.; Boyce, G.M.; Andrews, R. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Lawrence Berkeley Lab., CA (USA)). Jun 1987. Contract AC02-87CH10290. 33p. H. Order Number TI89000059/JAW.

A series of laboratory experiments were performed to determine the influence of deviatoric in situ stress on the form and orientation of hydraulic fractures in salt. The principal hydraulic fracturing tests were run on prismatic blocks confined in a polyaxial loading frame using flatjacks. The vertical stress and the minimum horizontal stress were 10.3 MPa for all tests. The maximum horizontal stress was varied form 10.3 MPa to 15.5 MPa to provide a range of horizontal stress ratios from 1.0 (hydrostatic) to 1.5. The fracturing oil contained a fluorescent dye that marked the fracture traces for mapping after the samples were split. At high stress ratios (1.5) the hydraulic fractures formed as two distinct traces emanating from opposite sides of the borehole in the maximum horizontal stress direction. At progressively lower stress ratios the orientations of the fractures varied about the maximum stress direction, and the fracture traces tended to branch. At stress ratios below between 1.10 and 1.13 the fracture no longer appeared to have an orientation controlled by the in situ stress directions. The results indicate that the form of the hydraulic fracture reflects whether or not the stresses are nearly hydrostatic. Fracture form can be determined by mapping dyed hydraulic fractures underground. The fractures should be made in portions of an underground facility that are to be excavated, and the fractures should be mapped as the excavation proceeds through the area of fracturing. 2 refs., 13 figs., 2 tabs.

12673 **(BMI/ONWI/C—301) Preclosure performance assessment review of the draft site characterization plan conceptual design report: Technical report.** Waite, D.A.; Gupta, R.; Ludwig, S.B.; Maheras, S.J.; Mayberry, J.J.; Plummer, A.M.; Tarapore, P.S. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Dec 1987. Contract AC02-87CH10290. 298p. H. Order Number TI89000064/JAW.

This report presents the preclosure performance assessment review (PAR) of the Site Characterization Plan Conceptual Design Report (SCP-CDR). The PAR was performed on the design presented in the SCP-CDR working draft, Revision 1, released in October 1986. After review this working draft became the "Site Characterization Plan Conceptual Design Report", Revision 1. There are two distinct objectives of the PAR: (1) to analyze the design presented in the SCP-CDR in terms of offsite and occupational radiological safety, and (2) to test safety assessment methods and tools. This report addresses only the first of the PAR objectives. The PAR analysis consists of assessments of offsite and occupational doses resulting from routine and abnormal repository events. The scope of the analysis is restricted to preclosure operations at the repository. This report addresses (1) the description of repository facilities and operations, (2) the development of radioactive material inventories and radiation dose rates, (3) the development of radioactive material release scenarios and source terms, and (4) the assessment of offsite and occupational radiation dose equivalents. This report contains a summary of the analyses in the above four areas, and analysis details are documented. The results of the assessments are compared with regulatory requirements to determine how the repository performs relative to the requirements. The analyses indicate that the offsite and occupational impacts comply with regulatory requirements. However, based on this preliminary analysis of the draft design document, the occupational impacts exceed the SCP-CDR design objective of 1 rem/year in some areas. 59 refs., 12 figs., 127 tabs.

12674 **(BMI/ONWI/C—305) Sample management implementation plan: Salt Repository Project.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 27 May 1987. Contract AC02-87CH10290. 115p. H. Order Number TI89000058/JAW.

The purpose of the Sample Management Implementation Plan is to define management controls and building requirements for handling materials collected during the site characterization of

the Deaf Smith County, Texas, site. This work will be conducted for the US Department of Energy Salt Repository Project Office (SRPO). The plan provides for controls mandated by the US Nuclear Regulatory Commission and the US Environmental Protection Agency. Salt Repository Project (SRP) Sample Management will interface with program participants who request, collect, and test samples. SRP Sample Management will be responsible for the following: (1) preparing samples; (2) ensuring documentation control; (3) providing for uniform forms, labels, data formats, and transportation and storage requirements; and (4) identifying sample specifications to ensure sample quality. The SRP Sample Management Facility will be operated under a set of procedures that will impact numerous program participants. Requesters of samples will be responsible for definition of requirements in advance of collection. Sample requests for field activities will be approved by the SRPO, aided by an advisory group, the SRP Sample Allocation Committee. This document details the staffing, building, storage, and transportation requirements for establishing an SRP Sample Management Facility. Materials to be managed in the facility include rock core and rock discontinuities, soils, fluids, biota, air particulates, cultural artifacts, and crop and food stuffs. 39 refs., 3 figs., 11 tabs.

12675 **(BMI/ONWI/C—311) Testing interface specification (TIS): Draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Golder Associates, Inc., Redmond, WA (USA)). Mar 1987. Contract AC02-87CH10290. 187p. H. Order Number TI89000047/JAW.

The Testing Interface Specification (TIS) for the Exploratory Shaft Facility in salt defines the facilities and technical support required by the Underground Testing contractor (UTC) for the proper execution of the planned test programs. It also specifies the timing and constraints of the planned activities in relation to the construction of the ESF. This TIS is based on information presented in the Underground Test Plan (UTP) (Golder Associates, 1986) and the supporting Study Plans and Technical Procedures which reference the ESF Final Preliminary Design (Parsons Brinckerhoff/PB-KBB, 1986). It is intended that the TIS will be used by the designer and the construction manager of the ESF. The designer will ensure that the facilities and utilities required to complete the test program will be available to the UTC, and that the time required to carry out individual testing activities will be properly incorporated into the overall construction schedule. The construction manager will use the TIS to define requirements in the following areas: transport of equipment and of materials, manpower scheduling to support the construction and testing activities, and provision of temporary utilities and services during construction. 9 refs., 38 figs., 14 tabs.

12676 **(CEA-DAS—474) Safety and regulations.** Devillers, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). May 1988. 10p. (In French). (CONF-8804201—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754936/JAW.

From Waste information meeting; Saclay, France (19 Apr 1988).

This paper, given in a waste information meeting held in Saclay, indicates the pragmatic approach used in France, in the safety and regulation fields, for radioactive wastes transport and storage.

12677 **(CEA-DPS—87-06) Results of radioactivity measurements along the French coasts during 1986.** Charmasson, S.; Daburon, M.L.; Jeanmaire, L.; Patti, F.; Willemot, J.M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire). Dec 1987. 39p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754937/JAW.

A number of sampling networks for the environmental monitoring of levels from radioactive waste releases from french nuclear plants have been set up by the DPS/SEAPS since 1983. Various marine and freshwater biological indicators are being collected regularly on the Channel and Mediterranean shores and at the level of the lower Rhone river. Data gathered in 1986 show the prevailing effects of the releases from La Hague reprocessing plant and Rhone waters on the Channel and the Mediterranean sea respectively. However, clear labelling due to the CHERNOBYL accident on April 26 appeared in May and afterwards; this was shown by the appearance or level increase of different radionuclides such as: /sup 137/Cs, /sup 134/Cs, /sup 131/I, /sup 110m/Ag, /sup 106/Ru, /sup 103/Ru. The sampling stations on the Mediterranean eastern shore were the most affected and the impact of CHERNOBYL was still present in December. At the most contaminated station, Nice, the health consequence, taking into account the annual maximum levels, led to a fraction of 8.10/sup -5/ of the dose limit (5 mSv.y/sup -1/) recommended by the International Commission on Radiological Protection.

12678 **(CNEA-NT—19/87) Vitrification of high-level liquid wastes.** Varani, J.L.; Petraitis, E.J.; Vazquez, Antonio. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Gerencia de Proteccion Radiologica y Seguridad). 1987. 16p. (In Spanish). (CNEA-REPO—23). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705317/JAW.

High-level radioactive liquid wastes produced in the fuel elements reprocessing require, for their disposal, a preliminary treatment by which, through a series of engineering barriers, the dispersion into the biosphere is delayed by 10 000 years. Four groups of compounds are distinguished among a great variety of final products and methods of elaboration. From these, the borosilicate glasses were chosen. Vitrification experiences were made at a laboratory scale with simulated radioactive wastes, employing different compositions of borosilicate glass. The installations are described. A series of tests were carried out on four basic formulae using always the same methodology, consisting of a dry mixture of the vitreous matrix's products and a dry simulated mixture. Several quality tests of the glasses were made 1: Behaviour in leaching following the DIN 12 111 standard; 2: Mechanical resistance; parameters related with the facility of the different glasses for increasing their surface were studied; 3: Degree of devitrification: it is shown that devitrification turns the glasses containing radioactive wastes easily leachable. From all the glasses tested, the composition SiO/sub 2/, Al/sub 2/O/sub 3/, B/sub 2/O/sub 3/, Na/sub 2/O, CaO shows the best retention characteristics. (M.E.L.).

12679 **(CNEA-NT—20/87) Evaluation of the vitreous matrices to include high-level radioactive wastes.** Varani, J.L.; Petraitis, E.J.; Pasquali, R.C. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Gerencia de Proteccion Radiologica y Seguridad). 1987. 15p. (In Spanish). (CNEA-REPO—24). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705318/JAW.

The Argentine Nuclear Programme considers a fuel cycle with Pu recycle. This will generate high-level liquid wastes, that should be safely eliminated. With this purpose, primary glasses utilizing three prototipe compositions were prepared. Simulated wastes oxides in the rate of about 10% were added to the vitreous matrices. The mixture was melted in ceramic melting pots in a muffle furnace at 1 100 deg C during 8 hours. Resistance leaching tests were made following an adaptation of the DIN 12 111 standard. Quantitative analysis of the leaching solutions were made to evaluate the solubility of the different elements. Glasses were observed with optical microscopy scanning before and after leaching. In the first, glasses, bubbles and crystalline-phase appear; in the second ones, puncture and embrittlement were detected. By means of differential thermoanalysis, endo and exothermal peaks were identified in glasses supporting gradual heating. X ray diffraction analysis were made in samples with and without wastes. The degree of crystallization of samples was evaluated by photographic and diffractometric techniques. Leaching studies showed the existance of a direct relation between leaching and glass alkaline content. (M.E.L.).

12680 **(CNEA-NT—27/87) Immobilization of high-level wastes into sintered glass: 2. Pressing process at ambient temperature.** Bevilacqua, A.M.; Russo, D.O.; Messi de Bernasconi, N.; Audero, M.A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Gerencia de Proteccion Radiologica y Seguridad). 1987. 12p. (In Spanish). (CNEA-REPO—31). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704942/JAW.

High level radioactive wastes are immobilized into borosilicate glasses. Experiences with the variety VG 98/12 (SiO/sub 2/, TiO/sub 2/, Al/sub 2/O/sub 3/, B/sub 2/O/sub 3/, MgO, CaO, Na/sub 2/O) are described. The pressing was performed in a matrix of 12.7 mm diameter, the walls of which were lubricated with sterotex dissolved in Cl/sub 4/C. The sintering was made in an horizontal electric furnace in air atmosphere at temperatures between 500 and 600 deg C. It was observed that the maximum density occurs at 605 deg C. Comparing both the hot and the cold pressing process, it is concluded that: (1) In spite of requiring more complex equipment the hot pressing process has the advantage that lower pressures are applied, with the consequent obtainment of waste blocks with larger diameters, and (2) it is advisable that pressing process should be performed in the definitive can. (M.E.L.).

12681 **(CONF-880982—4) Incineration of residue from paint stripping operations using plastic media blasting.** Helt, J.E.; Mallya, N. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005782/JAW.

From 10. annual industrial energy technology conference; Houston, TX, USA (13 Sep 1988).

A preliminary investigation has been performed on the environmental consequences of incinerating plastic-media-blasting (PMB) wastes from plant removal operations. PMB is similar to sandblasting although blasting taken place at a much lower pressure. The blasted media can be recovered and recycled several times, but ultimately a residue of paint dust/chips and attrited media dust are left for disposal. This residue is a dry solid that may potentially be classified as a hazardous waste. One possible alternative to depositing the waste residue directly into a hazardous waste landfill is incineration. Incineration would provide desirable volume reduction. However, the fate of heavy metals from the entrained paint waste is not known. Samples of PMB residue were combusted at temperatures between 690{degree}C and 815{degree}C with approximately 125% of the stoichiometric air. The ash remaining after combustion was then analyzed for heavy metal content and tested for leachability using the EPA toxicity characteristics leaching procedures (TCLP). 6 refs., 7 tabs.

12682 **(CONF-881054—42) Mixed waste characterization and certification at the Nevada Test Site.** Kawamura, T.A.; Dodge, R.L.; Fitzsimmons, P.K. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). 1988. Contract AC08-84NV10327. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005204/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

The Radioactive Waste Management Project at the Nevada Test Site (NTS) was recently granted interim status by the state of Nevada to receive mixed waste. The RCRA Part B permit application has been revised and submitted to the state. Preliminary indications are that the permit will be granted. In conjunction with revision of the Part B permit application, pertinent DOE guidelines governing waste acceptance criteria and waste characterization were also revised. The guidelines balance the need for full characterization of hazardous constituents with ALARA precepts. Because it is not always feasible to obtain a full chemical analysis without undue or unnecessary radiological exposure of personnel, process knowledge is considered an acceptable method of waste characterization. A balance of administrative controls and verification procedures, as well as careful documentation and high standards of quality assurance, are essential to the characterization and certification program developed for the NTS.

12683 **(DOE/HWP—24) Headquarters Air Force Logistics Command guidance manual for hazardous waste minimization (PACER REDUCE): Hazardous Waste Remedial Actions Program.** Jones, L.W.; Weeter, D.; Roth, J.A.; Debelak, K.A.; Bowers, A.R. (Oak Ridge National Lab., TN (USA). Hazwrap Support Contractor Office). Sep 1988. Contract AC05-84OR21400. 129p. (ORNL/M—615). NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005672/JAW.

This manual provides guidance for the Air Force Logistics Command (AFLC) Waste Minimization Program, called PACER REDUCE, and applies to all AFLC installations and personel who are responsible for implementing and monitoring activities relating to PACER REDUCE. This guidance for waste minimization provides management and technical approaches for assessing potential waste reduction techniques and for making informed decisions concerning industrial process and waste stream management. Such actions will assist in achieving regulatory compliance with the Resource Conservation and Recovery Act of 1976 as updated by the Hazardous and Solid Waste Amendments of 1984. 37 refs., 14 figs., 22 tabs.

12684 **(DOE/HWP—71) Proceedings of the Department of Energy Defense Programs hazardous and mixed waste minimization workshop: Hazardous Waste Remedial Actions Program.** (Oak Ridge National Lab., TN (USA). Hazwrap Support Contractor Office). Sep 1988. Contract AC05-84OR21400. 476p. (ORNL/M—651; CONF-8807118—Summ.). NTIS, PC A21 - OSTI. Order Number DE89004244/JAW.

From 1. workshop on hazardous and mixed waste minimization workshop; Las Vegas, NV, USA (28 Jul 1988).

The first workshop on hazardous and mixed waste minimization was held in Las Vegas, Nevada, on July 26--28, 1988. The objective of this workshop was to establish an interchange between DOE headquarters (DOE-HQ) DP, Operations Offices, and contractors of waste minimization strategies and successes. The first day of the workshop began with presentations stressing the importance of establishing a waste minimization program at each site as required by RCRA, the land ban restrictions, and the decrease in potential liabilities associated with waste disposal. Discussions were also centered on pending legislation which would create an Office of Waste Reduction in the Environmental Protection Agency (EPA). The Waste Minimization and Avoidance Study was initiated by DOE as an addition to the long-term productivity study to address the issues of evolving requirements facing RCRA waste management activities at the DP sites, to determine how major operations will be affected by these requirements, and to determine the available strategies and options for waste minimization and avoidance. Waste minimization was defined in this study as source reduction and recycling.

12685 **(DOE/OSTI—3406-Suppl.1-Add.1) Yucca Mountain Project bibliography, January--June 1988: An update: Civilian Radioactive Waste Management Program.** Tamura, A.T.; Lorenz, J.J. (comps.). (USDOE Office of Scientific and Technical Information, Oak Ridge, TN). Oct 1988. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE88015230/JAW.

The Nevada Nuclear Waste Storage Investigations Project was renamed the Yucca Mountain Project on August 5, 1988. This update contains information that was added to the DOE Energy Data Base during the first six months of 1988. The update is categorized by principal project participating organizations, and items are arranged in chronological order. Participant-sponsored subcontractor reports, papers, and articles are included in the sponsoring organization's list. Previous information on this project can be found in the Nevada Nuclear Waste Storage Investigations bibliographies, DOE/TIC-3406 which covers the years 1977--1985, and DOE/OSTI-3406(Suppl.1) which covers 1986 and 1987. These bibliographies contain indexes for Corporate Author, Personal Author, Subject, Contract Number, Report Number, Order Number Correlation and Key Word in Context.

12686 **(DOE/RL/11253—T1) Underground engineering at the Basalt Waste Isolation Project.** (National Committee for Rock Mechanics, Washington, DC (USA)). 1987. Contract AC06-87RL11253. 24p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006096/JAW.

A special task group was organized by the US National Committee for Rock Mechanics and the Board on Radioactive Waste Management of the National Research Council to address issues relating to the geotechnical site characterization program for an underground facility to house high-level radioactive waste of the Basalt Waste Isolation Project (BWIP). Intended to provide an overview of the geotechnical program, the study was carried out by a task group consisting of ten members with expertise in the many disciplines required to successfully complete such a project. The task group recognized from the outset that the short time frame of this study would limit its ability to address all geotechnical issues in detail. Geotechnical issues were considered to range from specific technical aspects such as in-situ testing for rock mass permeability; rock hardness testing in the laboratory; or geologic characterizations and quantification of joints, to broader aspects of design philosophy, data collection, and treatment of uncertainty. The task group chose to focus on the broader aspects of underground design and construction, recognizing that the BWIP program utilizes a peer review group on a regular basis which reviews the specific technical questions related to geotechnical engineering. In this way, it was hoped that the review provided by the task group would complement those prepared by the BWIP peer review group.

12687 **(DOE-RW—88.055) Background studies: climatic and geomorphological aspects of the evolution of shallow land burial sites for radioactive waste disposal.** (Department of the Environment, London (UK); Dames and Moore, London (UK)). Apr 1988. 109p. (DM-TR—7). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755543/JAW.

This report presents the results of a programme of background research into some climatic and geomorphological aspects of the evolution of shallow land disposal environments for radioactive wastes in Britain. The work has supported development of the TIME2 simulation code. Modelling approaches are presented and discussed, along with supporting data, for climatic change, ice sheet growth and decay, groundwater effects and denudation. The potential effects of periglacial processes on a repository are also briefly discussed.

12688 **(DOE-RW—88.056) Intermediate Level Waste Research Programme: Progress report for 1986/87 from the Waste Treatment and Disposal Working Party covering Joint Funded Work.** Claxton, D.G.S.A. (British Nuclear Fuels Ltd., Risley). (Department of the Environment, London (UK)). Jun 1988. 124p. (ILWRP—87-P1-19). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755544/JAW.

The Waste Treatment and Disposal Working Party (WTDWP) covered the areas of: ILW Product Evaluation; ILW and HLW Disposal Studies, and ILW and HLW Quality Checking. The objectives of the programme were to evaluate potential waste products arising from the treatment of ILW/HLW, and to develop appropriate techniques which could be used to check the quality of the finished waste product.

12689 **(DOE-RW—88.082) Geostatistical analysis of prevailing groundwater conditions and potential solute migration at Elstow, Bedfordshire.** MacKay, R.; Cooper, T.A.; Porter, J.D.; O'Connell, P.E.; Metcalfe, A.V. (NERC Water Resource Systems Research Unit (WRSRU), Dept. of Civil Engineering, Newcastle Univ. (UK)). (Department of the Environment, London (UK)). Jun 1988. 189p. (NEWU-TR—1). NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS. Order Number DE88705071/JAW.

A geostatistical approach is applied in a study of the potential migration of contaminants from a hypothetical waste disposal facility near Elstow, Bedfordshire. A deterministic numerical model of groundwater flow in the Kellaways Sands formation and adjacent layers is coupled with geostatistical simulation of the heterogeneous transmissivity field of this principal formation. A particle tracking technique is used to predict the migration pathways for alternative realisations of flow. Alternative statistical descriptions of the spatial structure of the transmissivity field are implemented and the temporal and spatial distributions of escape of contaminants to the biosphere are investigated.

12690 **(DP-MS—87-178) Savannah River Plant saltstone: formulation variability and operating limits.** Langton, C.A.; Wilhite, E.L. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 15p. (CONF-880839—14). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005331/JAW.

From 10. annual DOE low-level waste management conference; Denver, CO, USA (30 Aug 1988).

Saltstone is the Savannah River Plant (SRP) wasteform resulting from chemical reactions between low-level defense waste and cementitious solids. Operating limits for the saltstone process were derived from waste specifications, and proportioning limits. Specifications for the waste salt solution include limits on temperature, pH, concentrations of eight inorganic and two organic constituents, total radioactivity, total alpha activity, and concentrations of 13 radionuclides. Specifications for the cementitious solids are based on ASTM standards. Proportioning limits for dry solids and for blended solids to waste solution ratio were based on an experimental design that screened formulations on the basis of processability and leachability (potential impact to groundwater).

12691 **(DP-MS—88-112) TRU [transuranic] waste certification at the Savannah River Plant.** Legler, B.M. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 21p. (CONF-880850—18). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005317/JAW.

From American Institute of Chemical Engineers summer national meeting; Denver, CO, USA (21 Aug 1988).

The Waste Certification Facility (WCF) at the Savannah River Plant (SRP) assesses transuranic (TRU) waste in 55-gal drums by x-ray and neutron interrogation prior to shipment to the Waste Isolation Pilot Plant (WIPP) in New Mexico. The facility, equipment, and operation are described. Results of a Probabilistic Risk Assessment (PRA) show that the facility can be operated without undue risk to plant personnel, the public, and the environment. 4 figs.

12692 **(DP-MS—88-140) The effect of helium from tritium decay on the gas-solid equilibrium constant for La-Ni-Al tritides.** Walters, R.T. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). [1988]. Contract AC09-76SR00001. 8p. (CONF-890201—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002886/JAW.

From 118. AIME annual meeting; Las Vegas, NV, USA (26 Feb 1989).

Change in the equilibrium vapor pressure over LaNi/sub 4.25/ Al/sub 0.75/ tritide with helium in-growth has been observed for helium concentrations up to 10,000 appm. The change is a decrease in pressure from about 500 torr to 90 torr at 80{degree}C. This decrease is believed to be associated with a crystal lattice expansion due to helium, and is similar to the plateau pressure decrease as function of aluminum concentration for the family of LaNi/sub 5-x/Al/sub x/ alloys with $O < x < 1$. Subsequent tritium cycling recovers the plateau pressure. These data suggest that helium has very short range diffusion for the time of these observations. 18 refs., 4 figs., 2 tabs.

12693 **(DPST—88-607) Feeding formic acid onto the liquid surface.** Trinh, T.T. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 7 Nov 1988. Contract AC09-76SR00001. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004845/JAW.

Washed sludge/slurry will be transferred from the H-area waste tank farm to the Slurry Receipt and Adjustment Tank (SRAT) in the DWPF. In the SRAT, slurries will be concentrated and adjusted by reacting with formic acid under total reflux for six hours to reduce mercury to the elemental state. Based on previous

DWPF jumper design, formic acid was fed to the SRAT, and potentially to the SME and MFT through long unsupported diptubes. Experience on the full scale SRAT/SME has shown diptubes must be supported near the bottom to avoid excessive stress on the tank nozzles. The DWPF would like to eliminate these diptubes and feed formic acid onto the liquid surface to avoid the need for diptube supports in the tanks. Therefore, a test program was developed at TNX to evaluate the effect of feeding formic acid onto the liquid surface on tank vapor space corrosion and on formic acid overhead loss (Technology Issue 4.14). Results of the study revealed: (1) no evidence of formic acid overhead loss, (2) tank vapor space corrosion is insignificant (3.088 x 10/sup {minus}4/ inch/year) under DWPF conditions, and (3) there is no effect on the reaction yield or Melter operation. Details of the study are summarized below. 6 refs., 2 figs., 3 tabs.

12694 **(EGG-M—42387) Technologies for sorting, assaying, classifying, and certifying transuranic waste within the United States.** Clements, T.L. Jr. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 8p. (CONF-880510—4). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005270/JAW.

From IAEA-ECC international symposium on the management of low and intermediate level radioactive wastes; Stockholm, Sweden (16 May 1988).

A major objective of the US Department of Energy (DOE) Defense Waste Management Program is the proper management of defense generated Transuranic (TRU) waste. To meet this objective for newly-generated and stored TRU waste, the Waste Isolation Pilot Plant (WIPP), a deep geological repository, is being constructed for disposal of these wastes. Nondestructive examination and assay technologies have been developed, primarily for stored TRU waste, to evaluate waste package compliance with Waste Acceptance Criteria (WAC) requirements before shipment to WIPP. At the Idaho National Engineering Laboratory (INEL), the Stored Waste Examination Pilot Plant (SWEPP) was developed to provide nondestructive examination and assay techniques for examining and certifying TRU wastes without opening the waste container. These techniques include real-time x-ray radiography, passive and active neutron assay, and ultrasonic container integrity examination. These techniques provide the necessary information to ensure safe transportation, handling, and disposal of the waste at WIPP. 1 ref., 3 figs.

12695 **(EGG-M—88405) Compliance program data management system for The Idaho National Engineering Laboratory/Environmental Protection Agency.** Hertzler, C.L.; Poloski, J.P.; Bates, R.A.; Van Haaften, D.H.; Shea, J.P.; Fritz, L.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 10p. (CONF-881054—44). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005280/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

The Compliance Program Data Management System (DMS) developed at the Idaho National Engineering Laboratory (INEL) validates and maintains the integrity of data collected to support the Consent Order and Compliance Agreement (COCA) between the INEL and the Environmental Protection Agency (EPA). The system uses dBase III Plus programs and dBase III Plus in an interactive mode to enter, store, validate, manage, and retrieve analytical information provided on EPA Contract Laboratory Program (CLP) forms and CLP forms modified to accommodate 40 CFR 264 Appendix IX constituent analyses. Data analysis and presentation is performed utilizing SAS, a statistical analysis software program. Archiving of data and results is performed at appropriate stages of data management. The DMS is useful for sampling and analysis programs where adherence to EPA CLP protocol, along with maintenance and retrieval of waste site investigation sampling results is desired or requested. 3 refs.

12696 **(EGG-M—88436) Low-level and mixed waste treatment at the Idaho National Engineering Laboratory.** Gillins, R.L.; Larsen, M.M. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 7p. (CONF-881054—45). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005275/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

EG and G Idaho, Inc. conducts a program to evaluate low-level radioactive and radioactively contaminated hazardous (mixed) wastes generated at the Idaho National Engineering Laboratory and to develop safe, efficient, and cost effective treatment methods for these wastes. Treatment methods to reduce the volume of low-level wastes are in operation at the Waste Experimental Reduction Facility and have resulted in significant savings in burial space at the laboratory's low-level waste disposal site. Stabilization of mixed waste is also being performed to render the wastes nonhazardous. Other mixed waste treatment processes are being investigated to allow the INEL to render mixed wastes being generated and currently stored suitable for disposal. 1 fig., 2 tabs.

12697 **(ENEA-RT-COMB—88-2) "Ulisse" project for the treatment of radioactive wastes of ENEA Department of Fuel. A comparative study for defining the glass matrix to immobilize high activity wastes.** Broglia, M. (ENEA, Casaccia (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1988. 80p. (In Italian). NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705243/JAW.

The high-level liquid wastes producedby the Nuclear Fuel Cycle Department of the Italian Committee for R and D of Nuclear and Alternative Energy since 1970 up today, are characterized by a very high aluminum content which would seriously limit the option of their vitrification. A simple chemical process for the separation of the radioactive fraction from the aluminum nitrate solution before vitrification has been proposed, reducing by a factor 10 the finally obtainable glass-waste volume (the "ULISSE" Project). This comparative study of the "ULISSE" high-level waste and detailed compositions of preferred products from various international Laboratories should supply a good initial condition in a glass matrix design for waste immobilization, and a feed-back control on the Project parameters.

12698 **(ENEA-RT-DISP—86-2) Off-gas from beta-gamma low-level waste incineration: Italian treatment systems.** Masotti, E. (ENEA, Rome (Italy)). Mar 1987. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755390/JAW.

The incineration process for radioactive wastes permits the maximum reduction in their volume and chemical reactivity, ensures safe disposal and contributes decisively to the protection of man and the environment. The report indicates the regulatory requirements and limits for gaseous effluents and reviews the treatment systems for the off-gas produced by Italian experimental plants for the incineration of low-level beta-gamma wastes, including ion-exchange resins, radioactive mineral oils and solvents. Those plants which do not provide for off-gas treatment are excluded. Particular attention is given to the CRE Casaccia incineration plant because of the validity of the process and its high level of automation, which makes it easy to operate and follow the ALARA principles recommende by the ICRP. The plant also provides exceptional flexibility for experimentation. A critical examination of the described processes and plant concept and construction is also included.

12699 **(EPRI-NP—6159) An assessment of Boraflex performance in spent-nuclear-fuel storage racks: Final report.** Lindquist, K.; Kline, D.E. (Electric Power Research Inst., Palo Alto, CA (USA); Northeast Technology Corp., Kingston, NY (USA)). Dec 1988. 158p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004711/JAW.

Data from utility surveillance programs, test reactor irradiations and the open literature have been collected and evaluated to assess the effect of service environment in spent nuclear storage racks on the neutron absorber material, Boraflex. Radiation induced changes in the properties of Boraflex have been identified. The observed formation of gaps in the full length panels of Boraflex in some spent fuel racks has been attributed to one such change, shrinkage, in combination with mechanical restraint. Mechanisms of gap formation and growth are also discussed. Factors which may influence the ultimate service life of Boraflex in spent fuel storage racks have been identified. Continuation of coupon surveillance

programs to verify the serviceability of Boraflex in the spent fuel pool environment is recommended. Guidelines for coupon surveillance programs have been developed. 65 refs., 30 figs., 8 tabs.

12700 **(GAO/RCED—88-158) Nuclear waste.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 1988. 48p. General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

In August 1987, the Department of Energy released information showing the presence of Iodine-129, a radioactive material, in groundwater beneath its Hanford Reservation in southeastern Washington State. DOE's handling of the situation discouraged disseminating the information within and outside the agency. In fact, the discouragement was so pervasive that GAO believes DOE might never have publicly released the information if the Nuclear Regulatory Commission, through its on-site representative, had not identified and pursued the issue. DOE maintains that the available information concerning Iodine-129 migration is insufficient to disqualify Hanford from consideration; addressing it in the environmental assessment would not have affected its selection of Hanford as a candidate repository site. NRC and Washington State agree that not enough is known about the Iodine-129 migration issue to have rejected Hanford on that basis.

12701 **(INFO—0155) Geochemical analysis of core from a geothermal anomaly.** Haverslew, B.; Tammemagi, H.Y. (RE/SPEC Ltd., Calgary, Alberta (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Apr 1985. 73p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705108/JAW.

A mild geothermal area in western Montana, USA, has been studied, as a natural analog, to learn about the effects that long-term heat generated by a repository containing spent nuclear fuel might have on the surrounding rock mass. The results of previous geological, geophysical and hydrogeological studies are briefly summarized. Extensive petrological studies have been undertaken on core samples obtained from a 2 km deep borehole drilled into the Empire Creek Stock. These include a detailed petrographic study, x-ray diffraction analyses, scanning electron microscope and electron microprobe analyses, porosity and permeability measurements, oxygen isotope analyses, uranium disequilibrium analyses and K-Ar age determinations. The implications to deep burial of nuclear wastes are discussed. 40 refs.

12702 **(INFO—0195-1) Waste management implications of concentrating slimes - characteristics and potential problems.** (Atomic Energy Control Board, Ottawa, Ontario (Canada); Beak Consultants Ltd., Toronto, Ontario (Canada); Golder Associates, Toronto, Ontario (Canada)). May 1986. 114p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705373/JAW.

This report describes the geotechnical, geochemical and environmental characteristics of fine-grained uranium tailings (slimes) which may influence both short- and long-term management of slime-enriched uranium tailings impoundments. Properties of slimes are compared and contrasted with those of sand tailings using field and laboratory data primarily from naturally segregated tailings in the Elliot Lake area, Ontario and Northern Saskatchewan uranium-bearing regions of Canada. Key management considerations are included.

12703 **(INIS-mf—11883) HAW simulation experiments with cobalt-60 radiation sources in the Asse salt mine. R and D report 1986.** Rothfuchs, T.; Wieczorek, K.; Feddersen, H.K. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). 1986. 146p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756615/JAW.

The report describes the experimental work and the measured data of the joint German-American project for the HAW simulation experiment with cobalt-60 radiation sources in the Asse salt mine, covering the period up to the end of the third quarter 1986. The experiment is intended to yield information on the synergistic effects of heat and ionizing radiation on the salt rock under representative waste repository conditions. The investigations aim at the migration, release, and radiolytic decomposition of the water and gas components in the rock salt, and at the thermally induced strain and deformation processes. In addition, corrosion tests are planned to be made on various container test materials, and analyses of salt rock core samples for assessing the effect of heat and radiation on the rock. The report in hand presents all data obtained during the experiment. The results of the subsequent evaluation and verification studies will be presented in another report, the programme being given in an annex to the report in hand.

12704 **(INIS-mf—11884) Experimental storage of high-level radioactive wastes in the Asse salt mine - technical aspects. Concluding report - project phase 1.** Gies, H.; Rothfuchs, T.; Feddersen, H.; Graefe, V.; Gross, S.; Hente, B.; Jockwer, N.; Kessels, W.; Schwaegermann, H. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). [1988]. 90p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756616/JAW.

The work performed under this project in the Asse salt mine is an important milepost within the framework schedule of the 'Gorleben Poject' of Physikalisch-Technische Bundesanstalt (PTB). The project phase I (1982 - June 30, 1985) is about to be concluded at the time this report is published. The main points of interest of this project phase cover the planning of the experimental work, the design of experiments, and the first activities for developing the systems for handling the high-level radioactive wastes. The engineering development work has been advanced to the point where construction and manufacture of equipment can be started (transport containers Asse, TB1, collective transport containers, borehole gates, transport vehicles, waste positioning equipment, and borehole casing). Testing of the pipes for the last mentioned task with regard to the material's deformation behaviour will be done by the Dutch ECN as a sub-contractor. First laboratory experiments have been carried out on radiolysis gas formation, to complement the engineering work and the in-situ measuring programmes.

12705 **(NHRI—27) Retention of /sup 137/Cs and /sup 90/Sr by mineral sorbents surrounding vitrified nuclear waste.** Lyon, K.E.; Patterson, R.J. (Environment Canada, Ottawa, ON (Canada). National Hydrology Research Inst.). 1985. 27p. (IWD—148). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705312/JAW.

In June 1960, twenty-five 14-cm diameter hemispheres of vitrified nuclear waste (glass blocks) were buried in a shallow sand aquifer in the lower Perch Lake Basin, Chalk River Nuclear Laboratories, Ontario, Canada. Almost all leaching of the glass blocks occurred during the first 18 months of emplacement, and consequently the burial experiment approximated a single-injection source of /sup 137/Cs and /sup 90/Sr. After about 11 years, most of the /sup 90/Sr that was released had been advected and dispersed from the site, whereas the bulk of the /sup 137/Cs had travelled no more than 0.3 m from the blocks. Three piezometers were installed and five cores of sediment were collected at the glass block site in 1978. Mineralogically pure segregates of sand grains were prepared by hand and characterized using binocular, petrographic and scanning electron microscopy, X-ray diffraction, and energy-dispersive X-ray spectroscopy. A technique also was developed to measure very low levels of /sup 137/Cs and /sup 90/Sr by counting small (10-100 mg) sediment samples directly with a thin window, flow proportional counter. Results show that sand-sized grains of altered biotite (biotite-vermiculite), biotite, muscovite, hornblende and sericitized feldspar are able to retain /sup 137/Cs over a period of 18 years, and that grains of biotite-vermiculite, biotite and hematite-bearing feldspar (largely microline) can retain low levels of /sup 90/Sr over the same period of time. The amounts of /sup 137/Cs and /sup 90/Sr sorbed by the mineral grains ranged from undetectable levels to approximately 380 and 35 becquerels/gram sediment, respectively. This report contains the complete series of mineral segregates ranked on a weight basis according to the amounts of retained /sup 137/Cs and /sup 90/Sr. Ground-water quality data indicate that none of the retention is the result of the precipitation of strontium or cesium minerals.

12706 **(NRCN(LS)—020) Spent fuel and high-level radioactive waste storage. Literature survey.** Trigerman, S. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). Jun 1988. 56p. (In Hebrew). NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705390/JAW.

The subject of spent fuel and high-level radioactive waste storage, is bibliographically reviewed. The review shows that in the majority of the countries, spent fuels and high-level radioactive wastes are planned to be stored for tens of years. Sites for final disposal of high-level radioactive wastes have not yet been found. A first final disposal facility is expected to come into operation in the United States of America by the year 2010. Other final disposal facilities are expected to come into operation in Germany, Sweden, Switzerland and Japan by the year 2020. Meanwhile , stress is placed upon the 'dry storage' method which is carried out successfully in a number of countries (Britain and France). In the United States of America spent fuels are stored in water pools while the 'dry storage' method is still being investigated.

12707 **(NUREG/CR—5221) Biodegradation of ion-exchange media.** Bowerman, B.S.; Clinton, J.H.; Cowdery, S.R. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (USA)). Aug 1988. Contract AC02-76CH00016. 44p. (BNL-NUREG—52163). NTIS, PC A04/MF A01 - GPO - OSTI. Order Number TI89005218/JAW.

Ion-exchange media, both bead resins and powdered filter media, are used in nuclear power plants to remove radioactivity from process water prior to reuse or environmental discharge. Since the ion- exchange media are made from synthetic hydrocarbon-based polymers, they may be susceptible to damage from biological activity. The purpose of this study was to investigate some of the more basic aspects of biodegradation of ion-exchange media, specifically to evaluate the ability of microorganisms to utilize the ion-exchange media or materials sorbed on them as a food source. The ASTM-G22 test, alone and combined with the Bartha Pramer respirometric method, failed to indicate the biodegradability of the ion-exchange media. The limitation of these methods was that they used a single test organism. In later phases of this study, a mixed microbial culture was grown from resin waste samples obtained from the BNL High Flux Beam Reactor. These microorganisms were used to evaluate the susceptibility of different types of ion-exchange media to biological attack. Qualitative assessments of biodegradability were based on visual observations of culture growths. Greater susceptibility was associated with increased turbidity in solution indicative of bacterial growth, and more luxuriant fungal mycelial growth in solution or directly on the ion-exchange resin beads. 21 refs., 9 figs., 18 tabs.

12708 **(NUREG/CR—5229) Annual report of the TMI-2 [Three Mile Island Unit 2] EPICOR-II Resin/Liner Investigation: Low-Level Waste Data Base Development Program for fiscal year 1988.** Rogers, R.D.; McConnell, J.W. Jr.; Davis, E.C.; Jastrow, J.D. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1988. Contract AC07-76ID01570;AC05-84OR21400;W-31109-ENG-38. 38p. (EGG—2553). NTIS, PC A03/MF A01 - GPO - OSTI. Order Number TI89005987/JAW.

The TMI-2 EPICOR-II Resin/Liner Investigation: Low-Level Waste Data Base Development Program, funded by the US Nuclear Regulatory Commission (NRC), is studying the degradation effects in EPICOR-II organic ion exchange resins caused by radiation; examining the adequacy of test procedures recommended in the Branch Technical Position on Waste Forms to meet the requirements of 10 CFR 61 using solidified EPICOR-II resins; obtaining performance information on solidified EPICOR-II ion exchange resins in a disposal environment; and determining the condition of EPICOR-II liners. This report summarizes accomplishments of Fiscal Year 1988. The steps taken in preparation for the third sampling of ion exchange resins from EPICOR-II prefilters PF-8 and -20 determine degradation are noted under the Resin Degradation Task. In the Resin Solidification Task, the results of leachate analysis for Sr-90 are presented. The leachate samples were obtained from testing of waste forms after irradiation. Those results are compared to results from irradiated and unirradiated waste form Cs-137 leachate sample analysis. In the Field Testing Task, both Portland Type I-II cement and Dow vinyl ester-styrene waste forms are being tested in lysimeter arrays located at Argonne National Laboratory in Illinois (ANL-E) and Oak Ridge National Laboratory (ORNL). The study is designed so that continuous data on nuclide release and movement, as well as envirnomental conditions, will be obtained over a 20-year period. results of the third year of data acquisition are presented and discussed. 14 refs., 41 figs., 8 tabs.

12709 **(PB—89-122550/XAB) Use of geophysical monitoring systems and data to identify and designate ocean sites for disposal of low-level radioactive wastes. Final report.** Neiheisel, J. (Office of Radiation Programs, Washington, DC (USA)). Jul 1988. 16p. (EPA—520/1-88/012). NTIS, PC A03.

The report provides information applicable to using geophysical instruments and survey methods, and the data collected, in the process of designating sites for ocean disposal of low level radioactive wastes. The geophysical ocean survey methods described in the report are envisioned as preceding any sediment sampling required to characterize disposal sites.

12710 **(PNL—6315-2) Hanford Site ground-water monitoring for July through December 1987.** Evans, J.C.; Dennison, D.I.; Bryce, R.W.; Mitchell, P.J.; Sherwood, D.R.; Krupka, K.M.; Hinman, N.W.; Jacobson, E.A.; Freshley, M.D. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 660p. NTIS, PC A99/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005971/JAW.

The Pacific Northwest Laboratory monitors ground-water quality at the Hanford Site for the US Department of Energy to assess the impact of Site operations on the environment. Work undertaken between July and December 1987 included monitoring ground-water elevations across the Site, monitoring hazardous chemicals and radionuclides in ground water, geochemical evaluations of unconfined ground-water data, and calibration of ground-water flow and transport models. Water levels continued to rise in areas receiving increased recharge (e.g., beneath B Pond) and decline in areas where the release of water to disposal facilities has been terminated (e.g., U Pond). The major areas of ground-water contamination defined by monitoring activities are (1) carbon tetrachloride in the 200-West Area; (2) cyanide in and north of the 200-East and 200-West Areas; (3) hexavalent chromium contamination in the 100-B, 100-D, 100-F, 100-H, 100-K, and 200-West Areas; (4) chlorinated hydrocarbons in the vicinity of the Central Landfill and 300 Area; (5) uranium in the 100-F, 100-H, 200-West, and 300 Areas; and (6) tritium and nitrate across the Site. The MINTEQ geochemical code was used to identify chemical reactions that may be affecting the concentrations of dissolved hazardous chemicals in the unconfined ground water. Results indicate that many cations are present mainly as dissolved carbonate complexes and that a majority of the ground-water samples are in near equilibrium with carbonate minerals (e.g., calcite, dolomite, otavite).

12711 **(PNL—6427) Test plan for long-term, low-temperature oxidation of BWR spent fuel.** Einziger, R.E. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 30p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006387/JAW.

Preliminary studies indicated the need for more spent fuel oxidation data in order to determine the probable behavior of spent fuel in a tuff repository. Long-term, low-temperature testing was recommended in a comprehensive technical approach to (1) confirm the findings of the short-term thermogravimetric analysis tests; (2) evaluate the effects of variables such as burnup, atmospheric moisture,and fuel type on the oxidation rate; and (3) extend the oxidation data base to representative repository temperatures and better define the temperature dependence of the operative oxidation mechanisms. This document presents the test plan to study the effects of atmospheric moisture and temperature on oxidation rate and phase formation using a large number of boiling-water reactor fuel samples. Tests will run for up to two years, use characterized

fragmented and pulverized fuel samples, cover a temperature range of 110{degree}C to 175{degree}C, and be conducted with an atmospheric moisture content ranging from <{minus}55{degree}C to {approximately}80{degree}C dew point. After testing, the samples will be examined and made available for leaching testing. 15 refs., 2 figs., 2 tabs.

12712 **(PNL—6722) Surface stability test plan for protective barriers.** Ligotke, M.W. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1989. Contract AC06-76RL01830. 48p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006258/JAW.

Natural-material protective barriers for long-term isolation of buried waste have been identified as integral components of a plan to isolate a number of Hanford defense waste sites. Standards currently being developed for internal and external barrier performance will mandate a barrier surface layer that is resistant to the eolian erosion processes of wind erosion (deflation) and windborne particle deposition (formation of sand dunes). Thus, experiments are needed to measure rates of eolian erosion processes impacting those surfaces under different surface and climatological conditions. Data from these studies will provide information for use in the evaluation of selected surface layers as a means of providing stable cover over waste sites throughout the design life span of protective barriers. The multi-year test plan described in this plan is directed at understanding processes of wind erosion and windborne particle deposition, providing measurements of erosion rates for models, and suggesting construction materials and methods for reducing the effect of long-term eolian erosion on the barrier. Specifically, this plan describes possible methods to measure rates of eolian erosion, including field and laboratory procedure. Advantages and disadvantages of laboratory (wind tunnel) tests are discussed, and continued wind tunnel tests are recommended for wind erosion studies. A comparison between field and wind tunnel erosive forces is discussed. Plans for testing surfaces are described. Guidance is also presented for studying the processes controlling sand dune and blowout formation. 24 refs., 7 figs., 3 tabs.

12713 **(PNL—6745) Test plan for thermogravimetric analyses of BWR spent fuel oxidation.** Einziger, R.E. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 34p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006389/JAW.

Preliminary studies indicated the need for additional low-temperature spent fuel oxidation data to determine the behavior of spent fuel as a waste form for a tuffy repository. Short-term thermogravimetric analysis tests were recommended in a comprehensive technical approach as the method for providing scoping data that could be used to (1) evaluate the effects of variables such as moisture and burnup on the oxidation rate, (2) determine operative mechanisms, and (3) guide long-term, low-temperature oxidation testing. The initial test series studied the temperature and moisture effects on pressurized water reactor fuel as a function of particle and grain size. This document presents the test matrix for studying the oxidation behavior of boiling water reactor fuel in the temperature range of 140 to 225{degree}C. 17 refs., 7 figs., 3 tabs.

12714 (SAAS—360, pp 2-11) **Radioactive waste management policy and its implementation in the German Democratic Republic.** Sitzlack, G. 1988. NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780051/JAW. (CONF-830523—).

From International conference on radioactive waste management; Seattle, WA, USA (16 May 1983).

Waste management is considered an integral part of measures for the safe utilization of nuclear energy. In the German Democratic Republic, back in 1962 the government established the National Board for Nuclear Safety and Radiation Protection as a special body whose regulatory responsibilities include the setting up of an appropriate waste management policy for the country's nuclear power programme. After studies started in the 1960s a central system for the collection and disposal of low- and intermediate-level radioactive wastes from nuclear power plants and other sources throughout the country was established, this started operation a few years ago. The waste repository is a reconstructed salt mine which is operated by the main waste producer - the nuclear power plant utility. There are no current issues with high-level waste, as the spent fuels are stored for many years and then returned to the supplier country, the Soviet Union. The paper describes the relevant regulatory framework in the German Democratic Republic. The solution established here takes future nuclear power uses into account.

12715 **(SAAS—360) Report of the National Board of Nuclear Safety and Radiation Protection of the GDR.** (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1988. Vp. (CONF-830523—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780051/JAW.

From International conference on radioactive waste management; Seattle, WA, USA (16 May 1983).

Selected papers have been processed separately for inclusion in the Energy Data Base.

12716 **(SAND—85-0002) Total System Performance Assessment Code (TOSPAC): Volume 1, Physical and mathematical bases: Yucca Mountain Project.** Dudley, A.L.; Peters, R.R.; Gauthier, J.H.; Wilson, M.L.; Tierney, M.S.; Klavetter, E.A. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1988. Contract AC04-76DP00789. 204p. NTIS, PC A10/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006312/JAW.

TOSPAC is a computer program designed to simulate water flow and transport of soluble waste materials along ground water pathways through fractures, porous rock formations similar to those at Yucca Mountain, Nevada, a candidate site for a high-level nuclear-waste repository. The physical models and simplifying assumptions used are described, along with their mathematical formulation and the numerical techniques used to implement them. Example problems demonstrating the capabilities of the code are presented. 64 refs., 101 figs., 9 tabs.

12717 **(SKB-TR—87-33) SKB annual report 1987. Including summaries of technical reports issued during 1987.** (Swedish Nuclear Fuel and Waste Management Co., Stockholm). May 1988. 146p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756529/JAW.

The annual report on the activities of the Swedish Nuclear Fuel and Waste Management contains in part I an overview of SKB activities in different fields. Part II gives a description of the research and development work on nuclear waste disposal performed during 1987. Lectures and publications during 1987 as well as reports issued in the SKB technical report series are listed in part III. Part IV contains the summaries of all technical reports issued during 1987. At Forsmark the first construction phase for the final repository for radioactive waste - SFR - is now completed. The repository is situated in crystalline rock under the Baltic Sea. The first construction phase includes rock caverns for 60 000 m/sup 3/ of waste. A second phase for additional 30 000 m/sup 3/ is planned to be built and commissioned around the year 2000.

12718 **(SKB-TR—88-05) Description of geophysical data in the SKB database GEOTAB.** Sehlstedt, S. (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Feb 1988. 73p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756531/JAW.

For the storage of different types of data collected by SKB a database called Geotab has been created. The following data are stored in the database: Background data, geological data, geophysical data, hydrogeological data, hydrochemical data. This report describes the data flow for different types of geophysical measurements. The descriptions start with measurements and end with the storage of data in Geotab. Each process and the resulting data volume is presented separately. The geophysical measurements have been divided into the following subjects: Geophysical ground surface measurements, profile measurements; geophysical ground surface measurements, grid net measurements; geophysical borehole logging; petrophysical measurements. Each group of measurements is described in an individual chapter. In each chapter several measuring techniques are described and each method has a data table and a flyleaf table in Geotab.

12719 **(SKB-TR—88-07) Tectonic studies in the Lansjaerv region.** Henkel, H. (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Oct 1987. 72p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756532/JAW.

This report contains the results and the analysis of ground geophysical measurements and the tectonic interpretation in the 150x200 km Lansjaerv study area. It describes the data and methods used. The significance of strike slip fault patterns in relation to the surface morphology is discussed. The obtained results are used to suggest a tentative model for the present tectonic deformation. The report is part of the bedrock stability programme of SKB. The major conclusions regarding the tectonic structure are: Three regional fault systems are identified, two steep NW and N trending and a third NNE trending with gentle ESE dips, the steep fault systems have strike slip generated deformation patterns both in the Precambrian structures and in the surface morphology, the postglacial faults of the area are part of this fault pattern and represent movements mainly on reactivated, gently dipping zones, several suspected late or post-glacial, fault related features are found along the steep NW and N faults. Sites for drilling and geodetic networks for deformation measurements are suggested. Detailed background data are documented in additional 4 reports. The basic geophysical and geological datasets are documented in color plotted 1:250 000 maps. A tectonic interpretation map in the same scale has been produced by combined interpretation of magnetic, elevation, elevation relief and gravity data. (orig./HP) With 6 maps.

12720 **(SKI—86075) Progress in developing a model for interaction of bituminized waste products with water.** Haeggblom, H.; Wingefors, S. (Studsvik Energiteknik AB, Nykoeping (Sweden); Swedish Nuclear Power Inspectorate, Stockholm). (Swedish Nuclear Power Inspectorate, Stockholm; Studsvik Energiteknik AB, Nykoeping (Sweden)). 27 Oct 1987. 43p. (STUDSVIK-NS—87-187). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756205/JAW.

The reported work is part of a study of long-term properties of bituminized waste products. The long-term goal is: - estimating the swelling and degradation of an agglomerate of ion exchange resins and bitumen when submerged in water, - estimating the consequent pressure build-up and degradation of surrounding barriers in the repository. The report describes the first steps in calculating diffusion of water into the heterogeneous medium of ion exchange resins and bitumen and the consequent swelling of the material. Different models for the effective diffusivity are applied and implemented into a new version of the code GEOPATH which then also considers the swelling due to water uptake. Two-dimensional cylindrical geometry is considered. Results from some test calculations are shown. It is concluded that swelling is an important effect which can be handled theoretically if basic data are available. (authors).

12721 **(STRIPA-TR—87-18) Crosshole investigations: Hydrogeological results and interpretations.** Black, J.H.; Holmes, D.C.; Brightman, M.A. (British Geological Survey, Nottingham). (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Dec 1987. 85p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756536/JAW.

The Crosshole Programme was an integrated geophysical and hydrogeological study of a limited volume of rock (known as the Crosshole Site) within the Stripa mine. Borehole radar, borehole seismic and hydraulic methods were developed for specific application to fractured crystalline rock. The hydrogeological investigations contained both single borehole and crosshole test techniques. A novel technique, using a sinusoidal variation of pressure, formed the main method of crosshole testing and was assessed during the programme. The strategy of crosshole testing was strongly influenced by the results from the geophysical measurements. The longer term, larger scale hydrogeological response of the region was asessed by examining the variation of heads over the region. These were responding to the presence of an old drift. A method of overall assessment involving minimising the divergence from a homogeneous response yielded credible values of hydraulic conductivity for the rock as a whole.

12722 **(UCID—20926) Spent fuel performance data: An analysis of data relevant to the NNWSI Project.** Oversby, V.M.; Shaw, H.F. (Lawrence Livermore National Lab., CA (USA)). Aug 1987. Contract W-7405-ENG-48. 53p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006016/JAW.

This paper summarizes the physical and chemical properties of spent light water reactor fuel that might influence its performance as a waste form under geologic disposal conditions at Yucca Mountain, Nevada. Results obtained on the dissolution testing of spent fuel conducted by the NNWSI Project are presented and discussed. Work published by other programs, in particular those of Canada and Sweden, are reviewed and compared with the NNWSI testing results. An attempt is made to relate all of the results to a common basis of presentation and to rationalize apparent conflicts between sets of results obtained under different experimental conditions.

12723 **(UCID—21100) Thermomechanical calculations pertaining to experiments in the Yucca Mountain exploratory shaft.** Montan, D.N. (Lawrence Livermore National Lab., CA (USA)). Apr 1987. Contract W-7405-ENG-48. 35p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006015/JAW.

Waste Package Environment Tests are being planned for the NNWSI Exploratory Shaft to provide information about the near-field hydrological, thermal, and mechanical environment of the waste package for use in assessing the expected performance of the waste package subsystem. The rationale of the tests is driven by the need for this information, but is constrained by the measurement capabilities that can be applied in situ and by the ability of analytical and numerical models to use the data obtained with the measurements. A secondary purpose of the tests is to provide the option of testing certain components that might be part of the engineered barrier system. The Waste Package Environment Tests will be located in drifts at a depth of approximately 310 m (1020 ft) in the Exploratory Shaft. The tests will be separated from one another by at least 6.1 m (20 ft) based on the need to avoid interaction of the individual tests. This planned minimum separation will be refined as scoping and design calculations proceed. The actual test locations within the access drift will be dependent on local geology. 8 refs., 28 figs.

12724 (UTNL-R—212, pp 3-17) **Use of performance assessment in the design of spent fuel storage and high-level waste repository facilities.** Norman, N.A. (Bechtel National, Inc., San Francisco, CA (USA)). Nov 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780050/JAW. (CONF-8709395—).

From Adhoc nuclear workshop: nuclear electric power base in the Asia-Pacific; Tokyo, Japan (4 Sep 1987).

Efforts are under way to apply the systems engineering process to design activity at Bechtel for a number of clients. In the new application presented here, system performance is used as the measure of the acceptability of a design alternative. Repository and monitored retrievable storage (MRS) design bases for the repository are derived from DOE interpretation of numerous regulatory documents. Design requirements prepared from these sources, along with known or generic site parameters, are used to prepare the design bases. At the conceptual design phase, site data may be available, but are not detailed. From the bases, a performance-driven system design process can be implemented: prepare design alternatives; assess performance; and reevaluate alternatives and design bases and revise design to eliminate unacceptable concequences. Performing probabilistic risk assessments (PRAs) during conceptual design requires an innovative application of PRA techniques due to incomplete and soft design details at the conceptual level. In the scenario development and FMEA activities, when the engineering design team conducts these analyses, there can be direct interactions and discussions between the design specialists and the PRA analysis on the team. (Nogami, K.).

12725 **(WHC-SA—0306) Hanford waste management.** Lerch, R.E. (Westinghouse Hanford Co., Richland, WA (USA)). Apr 1988. Contract AC06-87RL10930. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004662/JAW.

This document consists of a transcript of a speech briefly covering the waste management program at Hanford. (TEM)

12726 **Geostatistical, sensitivity, and uncertainty methods for ground-water flow and radionuclide transport modeling: Proceedings.** Buxton, B.E. (ed.). Columbus, OH; Battelle Memorial Institute (1989). 658p. Battelle Press, 505 King Avenue, Columbus, OH 43201-2693. Order Number TI89004702/JAW. Contract AC02-83CH10139.

From Geostatistical sensitivity and uncertainty methods for groundwater flow and radionuclide transport modeling conference; San Francisco, CA, USA (15 Sep 1987).

The overall theme of the DOE/AECL '87 conference was the application of statistical methods for sensitivity and uncertainty analysis to nuclear waste disposal flow and transport modeling. The conference was organized into six technical sessions dealing with different topics in that theme: the role of statistical methods in the nuclear waste repository performance assessment plans of several waste disposal programs, sensitivity and uncertainty methods for large computer codes, stochastic hydrology, statistical methods for modeling flow and transport in fractured media, geostatistical methods, and the use of subjective information to supplement hard data in performance assessment studies. Thirty-one presentations were made in the six sessions. Several presentations were invited from well-known authorities in the various technical fields. These invited presentations were supplemented by the contributed presentations of researchers from seven different countries. At the combustion of the technical sessions, an open discussion session was held to address areas of concern to all conference attendees.

12727 **Results of studies on the behavior of spent fuel in storage.** Gilbert, E.R.; Bailey, W.J.; Johnson, A.B. Jr. (Pacific Northwest Labs., Richland, WA (US));. *JNMM;* **16**: No. 3, 27-37(Apr 1988).

Spent fuel integrity is a major consideration in licensing actions for spent fuel storage technologies. While wet storage continues to be the predominant U.S. spent fuel management technology, dry storage has been licensed and implemented in the U.S. Rod consolidation technology is being developed and demonstrated. This paper summarizes the status of technology trends and understanding regarding fuel behavior for the three technologies.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 12648, 12649, 12669, 12670, 12671, 12672, 12673, 12674, 12675, 12681, 12682, 12683, 12686, 12689, 12690, 12691, 12694, 12696, 12699, 12700, 12707, 12710, 12712, 12716, 12722, 12726, 12737, 13555, 13590, 13591

12728 **(DOE/EH—0079-Vol.2) Environment, safety, and health needs of the US Department of Energy: Volume 2, Site summaries.** (USDOE, Washington, DC). Dec 1988. 284p. NTIS, PC A13/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005699/JAW.

This volume presents projections of environment, safety, and health activities and associated resources needed at individual US Department of Energy (DOE) sites to maintain or, where required, to achieve compliance with applicable environmental, safety, and health requirements or to meet DOE objectives. The projections were developed from information provided by DOE Operations Offices, based on Environment, Safety, and Health Long-Range Plans developed by the sites in accordance with guidance from DOE Headquarters. This volume also contains projections of resource needs and activities for programs for which Headquarters has direct operational responsibility.

12729 **(INFO—0187) Analysis of factors affecting aerosol, unattached fraction and radon progeny measurements in mines.** Phillips, C.R.; Khan, A. (Toronto Univ., Ontario (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Dec 1985. 155p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88705264/JAW.

Data from measurements of unattached fractions and aerosol and activity size distributions obtained in Elliot Lake uranium mines in Jan/Feb 1985 are analyzed in detail. Approximating the bimodal activity size distribution - one mode is the unattached fraction, the other mode is the attached fraction - by a unimodal distribution (for the attached fraction) is justified for up to at least an assumed 10% unattached fraction. This assumed unattached fraction is substracted from the counts on the reference filter in the procedure for examining the validity of the approximation. The effect of the approximation on the median diameter of the aerosol is negligible. The unattached fraction determined from the difference in reference and back-up filter activities is much more accurate when based on gross alpha counts than when based on radionuclide concentrations calculated from the filter activities. Calculation of the unattached fraction from counts on the wire screen and on the reference filter yields smaller unattached fractions than from counts on the reference and on the back-up filter, for reasons not understood. The overall precision of measurement for the wire screen method, however, is much poorer than for the reference-back-up method. Theoretical determination of the unattached fraction is very sensitive to the age of the air, especially for relatively young air (age<20min). The hybrid theory of attachment describes the attachment mechanism. Unattached fractions determined by this theory are consistent with those calculated from the reference and back-up filter measurements. The use of a single count median diameter rather than the complete size spectrum of aerosols introduces large errors in the theoretical determination of unattached fraction, especially for Pb-214 and Bi-214. The measurement methodology, mine data, details of the data analysis techniques, and the results are all presented in this report.

12730 **(NUREG/CR—4950-Vol.3) The Shoreline Environment Atmospheric Dispersion Experiment (SEADEX): Airborne LIDAR data.** Johnson, W.B.; Cantrell, B.K.; Morley, B.M.; Uthe, E.E.; Nitz, K.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; SRI International, Menlo Park, CA (USA)). Dec 1988. 221p. NTIS, PC A10/MF A01 - GPO - OSTI. Order Number TI89005985/JAW.

The Shoreline Environment Dispersion Experiment (SEADEX) was a major field experimental program sponsored by the US Nuclear Regulatory Commission (NRC) for the purpose of acquiring a comprehensive, high-quality data base for evaluating models of dispersion within coastal zones. A secondary objective of the program was to provide data to help determine which meteorological measurements are most appropriate for emergency preparedness at nuclear power plant sites. The first field study in this program, SEADEX-I, was conducted in the vicinity of Kewaunee, Wisconsin, on the western shore of Lake Michigan, during the period 28 May-8 June 1982. SRI International was responsible for the design and direction of the field study, as well as for the conduct of some of the measurements. The field-study design included dispersion measurements of oil-fog (aerosol) and SF_6 (gas) tracers released simultaneously from the same point, as well as extensive meteorological measurements. This volume covers the airborne lidar data collected by the ALPHA-1 (Airborne Lidar Plume and Haze Analyzer) system operated on board SRI's Queen Air aircraft. The basic ALPHA-1 data consist of vertical cross sections of relative aerosol density within the oil-fog tracer plume, obtained from the down-looking lidar measurements as the aircraft flew over the plume, generally in a cross-plume direction. The vertical cross sections are made up of lidar profiles of relative aerosol obtained at the rate of 5 profiles/sec, which translates to 12 m of horizontal distance between profiles. The lidar data also include measurements of underlying terrain heights, as well as ambient boundary-layer aerosol distributions. 4 refs., 15 figs., 4 tabs.

0540 Health And Safety

REFER ALSO TO CITATION(S) 12649, 12724, 12728, 12960, 12965, 13026, 13049, 13050, 14074, 14076

12731 **(CONF-8811101—4) Health and safety training for hazardous waste site activities at Oak Ridge National Laboratory: Implementation of OSHA 29 CFR 1910.120(e).** White, D.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005915/JAW.

From 12. annual TRADE conference; San Francisco, CA, USA (7 Nov 1988).

Training provisions require a minimum of 40 hours of initial instruction off the site for employees involved in corrective operations and cleanup activities at hazardous waste sites. A less detailed training requirement of 24 hours is specified for employees working in more routine treatment, storage, and disposal activities. Managers and supervisors who are directly responsible for or who supervise employees engaged in hazardous waste operations must complete 8 additional hours of training related to management of hazardous waste site activities. A training program has been developed at Oak Ridge National Laboratory (ORNL) to comply with the need to protect the safety and health of hazardous waste workers. All hourly requirements specified in the interim final rule are met by a comprehensive program structure involving three stages of training. This paper will outline and discuss the content of each of these stages of the program. The involvement of various ORNL organizations in facilitating the training will be highlighted. Implementation strategies will be discussed as well as progress made to date. 7 refs.

12732 **(DOE/ID/12584—34) Soiled-based uranium disequilibrium and mixed uranium-thorium series radionuclide reference materials.** Donivan, S.; Chessmore, R. (UNC Geotech, Grand Junction, CO (USA)). Dec 1988. Contract AC07-86ID12584. 14p. (UNC/GJ—37(TMC)). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006392/JAW.

The US Department of Energy (DOE) Office of Remedial Action and Waste Technology has assigned the Technical Measurements Center (TMC), located at the DOE Grand Junction Colorado, Projects Office and operated by UNC Geotech (UNC), the task of supporting ongoing remedial action programs by providing both technical guidance and assistance in making the various measurements required in all phases of remedial action work. Pursuant to this task, the Technical Measurements Center prepared two sets of radionuclide reference materials for use by remedial action contractors and cognizant federal and state agencies. A total of six reference materials, two sets comprising three reference materials each, were prepared with varying concentrations of radionuclides using mill tailings materials, ores, and a river-bottom soil diluent. One set (disequilibrium set) contains varying amounts of uranium with nominal amounts of radium-226. The other set (mixed-nuclide set) contains varying amounts of uranium-238 and thorium-232 decay series nuclides. 14 refs., 10 tabs.

12733 **(DOE/OR/21548—020) Hydrogeologic investigations sampling plan: Revision 0.** (MK-Ferguson Co., St. Charles, MO (USA); Jacobs Engineering Group, Inc., St. Charles, MO (USA)). Nov 1988. Contract AC05-86OR21548. 290p. NTIS, PC A13/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005720/JAW.

The goal of this sampling plan is to identify and develop specific plans for those investigative actions necessary to: (1) characterize the hydrologic regime; (2) define the extent and impact of contamination; and (3) predict future contaminant migration for the Weldon Spring Site (WSS) and vicinity. The plan is part of the Weldon Spring Site Remedial Action Project (WSSRAP) sponsored by the US Department of Energy (DOE) and has been developed in accordance with US EPA Remedial Investigation (RI) and Data Quality Objective (DQO) guidelines. The plan consists of a sequence of activities including the evaluation of data, development of a conceptual model, identification of data uses and needs, and the design and implementation of a data collection program. Data will be obtained to: (1) confirm the presence or absence of contaminants; (2) define contaminant sources and modes of transport; (3) delineate extent of contaminant migration and predict future migration; and (4) provide information to support the evaluation and selection of remedial actions. 81 refs., 62 figs., 26 tabs.

12734 **(DOE/OR/21548—039) Engineering evaluation/cost analysis for the proposed management of contaminated water in the Weldon Spring quarry.** MacDonell, M.M.; Peterson, J.M.; Joya, I.E. (Argonne National Lab., IL (USA)). Jan 1989. Contract AC05-86OR21548;W-31109-ENG-38. 147p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005765/JAW.

This engineering evaluation/cost analysis (EE/CA) report has been prepared to support the proposed removal action for management of contaminated water in the Weldon Spring quarry, located near Weldon Spring, Missouri. The water became chemically and radioactively contaminated as a result of contact with various wastes that were disposed of in the quarry between 1942 and 1968. The US Department of Energy is responsible for cleanup activities at the Weldon Spring site, which includes the quarry, under its Surplus Facilities Management Program (SFMP). The major goals of SFMP are to eliminate potential hazards to the public and the environment that are associated with contamination at SFMP sites and to make surplus real property available for other uses, to the extent possible. The objectives of the EE/CA report are to identify the cleanup as a removal action, to document the selection of response activities that will mitigate the potential for release of radioactive or chemical contaminant for the quarry water into the nearby environment, and to address environmental impacts associated with the proposed action. Pursuant to the evaluation alternatives in this report, it is proposed that the water be pumped from the quarry pond to a newly constructed treatment plant for removal of the contaminants of concern. This removal action is necessary for and consistent with the overall response action being planned to minimize potential threats to the public and the environment associated with the current contamination at the quarry. 66 refs., 15 figs., 32 tabs.

12735 **(INFO—0193) Study of factors that influence the use of respirators in uranium mines.** Kalos, F. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jun 1986. 64p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705118/JAW.

A statistical analysis was performed of the responses to a user's survey by uranium miners who were voluntary users of a helmet-type powered respirator. The analysis concludes that the duration of visor-lifting was lognormally distributed with a geometric mean of 1.15 hours. Use depends strongly on job category. Many of the factors examined by the survey were use-dependent instead of use-dtermining, or had no effect on proper use. Many of the miners stated the respirator could not cope with hard work, its visor fogged up. The very abundance of these comments prevented confirming an association between fogging and use by statistical means. Recommendations on future user's surveys are given.

12736 **(INIS-BR—1354) Psychological impact of the radiological accident in Goiania.** Carvalho, A.B. de. (Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ). 1988. 83p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705152/JAW.

This work describes the psychological impact of an accident caused by the violation of a capsule containing Cesium 137 in the city of Goiania, Goias, Brazil, in September of 1987. Its object is to confirm the importance of having mental health teams working, not only with accident victims, but also side by side with the rescue teams in the event of radiation accidents.

12737 **(NP—8011453) Draft final feasibility study for Montclair/West Orange and Glen Ridge, New Jersey radium sites.** (Camp Dresser and McKee, Inc., Edison, NJ (USA)). 13 Sep 1985. 0p. OSTI - Camp Dresser and McKee Inc., Raritan Plaza III, Raritan Center, Edison, New Jersey 08817. Order Number TI88011453/JAW.

The Montclair/West Orange and Glen Ridge Radium Sites are three noncontiguous radium-contaminated sites consisting of 45 acres in Montclair, 9 acres in West orange and 50 acres in Glen Ridge. All three sites are located in densely residential areas of suburban Essex County in northeastern New Jersey. Radium-contaminated soils have been deposited as fill material around and under homes in the three sites causing elevated radiation exposures that pose a danger to the health of the residents of these areas, The radiation exposures consist of elevated indoor concentrations of radon gas—a decay product of radium, and elevated outdoor and indoor gamma radiation levels that approach and sometimes exceed the radiological standards for the general public. The US Environmental Protection Agency (EPA) contracted with Camp Dresser and McKee Inc. (CDM) to evaluate the feasibility of alternative plans to remediate the contamination at the three sites. Because several remediation alternatives will require disposal of large amounts of contaminated soil, a variety of different disposal alternatives also were evaluated. The overall objective of the remedial action at the Montclair/West Orange and Glen Ridge Radium Sites is to minimize or eliminate the potential health hazard produced by the radioactive- contaminated soils present in the three communities. The purpose of this study is to provide the information necessary to select the most appropriate methods to remediate the contamination at the sites and to dispose of the contaminated material.

12738 **(NP—8011467) Remedial investigation study for the Montclair/West Orange and Glen Ridge, New Jersey radium sites: Volume 1.** (Camp Dresser and McKee, Inc., Edison, NJ (USA)). 13 Sep 1985. 121p. OSTI - Camp Dresser and McKee Inc., Raritan Plaza III, Raritan Center, Edison, NJ 08817. Order Number TI88011467/JAW.

Elevated radiation exposures that approach and sometimes exceed the radiological standards for the general public have been identified in the Montclair/West Orange and Glen Ridge study areas. Elevated outdoor and indoor gamma radiation levels and indoor radon concentrations in excess of expected background ranges have been found. The source of the elevated radiation exposure is known to be radium-contaminated soil that has been deposited as fill material in several discrete pockets throughout the study areas. 17 refs., 20 tabs.

12739 (SAAS-Mitt—88-05, pp 2-12) **Recommendations for determining and evaluating surface contaminations.** 1988. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780048/JAW.

In Report of the National Board of Nuclear Safety and Radiation Protection.

The recommendations are to be applied to the determination and evaluation of surface contaminations (SCs) connected with the use of nuclear energy unless otherwise stipulated in the licensing procedure. Contents: limits; determination of SCs; determination of loose SCs including devices and materials, wipe test, measuring and evaluation of wipe tests; determination of fixed SCs; error assessment, evaluation of SCs.

12740 **(SAAS-Mitt—88-05) Report of the National Board of Nuclear Safety and Radiation Protection.** (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1988. Vp. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780048/JAW.

Selected papers have been processed separately for inclusion in the Energy Data Base. (AT)

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 12662, 12662

12741 **(DOE/DP—0051-1) Semiannual report on strategic special nuclear material inventory differences.** (USDOE Assistant Secretary for Defense Programs, Washington, DC. Office of Safeguards and Security). Jan 1989. 32p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006561/JAW.

This twenty-third periodic semiannual report of unclassified Inventory Differences (ID's) covers the first six months of fiscal year 1988 (October 1, 1987 through March 31, 1988) for all key Department of Energy (DOE) and DOE contractor operated facilities possessing strategic special nuclear materials. Classified information is not included in this report. This classified information includes data for the Rocky Flats and Y-12 nuclear weapons production facilities or facilities under ID investigation. However, classified ID data from such facilities receive the same scrutiny and analyses as the included data. The data in this report have been prepared and reviewed by DOE contractors, field offices, and Headquarters. When necessary, special investigations have been performed in addition to these reviews. The ID data, explanations, reviews, and any additional special investigations, together with the absence of physical indications of any theft attempt, support a finding that no theft of diversion of significant quantities of strategic special nuclear material has occurred in DOE facilities during the six-month period covered by this report.

12742 **(DP-MS—88-38) Integrated physical security system at the Savannah River Plant.** Meese, C.R.; Reeve, H.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 6p. (CONF-880631—59). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005318/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, United States (26 Jun 1988).

E.I. du Pont de Nemours and Company, under contract to the Department of Energy, operates the Savannah River Plant for the production of defense nuclear materials. The site encompasses a fuel fabrication facility, three operating nuclear reactors, and two fuel processing facilities, which are separated by as much as 15 miles. A safeguards intrusion detection and access control system designed by Sandia National Laboratories, Albuquerque, has been in operation at the reactor sites starting in September of 1984. During the same timeframe an analysis of the plantsite determined the desirability of an integrated plant safeguards system encompassing all six noted facilities. This paper describes the integrated system architecture, which includes facility access control systems, entry control facilities, a plantwide access enrollment system, intrusion detection systems, area central alarm stations, a plantwide backup central alarm station, and an extensive safeguards communications system. Design of the additional portion of the system began in 1985 and will be completed in 1990. Construction began in 1987 and will be completed in 1992. Provisions of the integrated system described is a large effort. The plantwide project effort approaches $150 million in cost and encompasses: Four miles of communication loop; nine entry control facilities; three central alarm stations; twenty-four major computers; and a 12,000-alarm point capacity system. 1 ref., 5 figs.

12743 **Characterization of activated metals in spent fuel hardware.** Lukic, A.T. (Pacific Northwest Lab., Richland, WA (US));. *JNMM;* **16**: No. 3, 19-23(Apr 1988).

Pacific Northwest Laboratory (PNL), for the U.S. Department of Energy (DOE), has been investigating the activation of spent fuel hardware in order to properly account for it in the federal waste management system. The paper presents a description and status of the program and tentative conclusions.

0560 Legislation And Regulations

REFER ALSO TO CITATION(S) 12642, 12663, 12727, 12731, 12743

12744 **(INIS-mf—11333) Preparation of an application for a prescribed substance licence. Regulatory Guide.** (Atomic Energy Control Board, Ottawa, Ontario (Canada)). 31 Jul 1987. 7p. (In English, French). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705190/JAW.

French translation included. Regulatory document R-75.

The purpose of this application is to provide the Atomic Energy Control Board (AECB) with all the relevant information necessary to assess the applicant's need for a Prescribed Substance Licence (PSL) and the applicant's ability to ensure: (a) the health and safety of the applicant's employees and of the general public;

(b) a minimal effect on the environment; and (c) the security of the prescribed substance(s). The purpose of this guide is to assist prospective applicants in completing PSL application forms.

12745 **(INIS-mf—11334) Regulatory objectives, requirements and guidelines for the disposal of radioactive wastes - long-term aspects. Regulatory policy statement.** (Atomic Energy Control Board, Ottawa, Ontario (Canada)). 5 Jun 1987. 14p. (In English, French). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705191/JAW.

French translation included. Regulatory document R-104.

It is the purpose of this document to present the regulatory basis for judging the long-term acceptability of radioactive waste disposal options, assuming that the operational aspects of waste emplacement and facility closure satisfy the existing regulatory framework of requirements. Basic objectives of radioactive waste disposal are given, as are the regulatory requirements which must be satisfied in order to achieve these objectives. In addition, guidelines are given on the application of the radiological requirements to assist proponents in the preparation of submissions to the Atomic Energy Control Board (AECB). The primary focus of the requirements is on radiation protection, although environmental protection and institutional controls are also addressed in a more general way since these factors stem directly from the overall objectives for radioactive waste disposal.

12746 (SAAS-Mitt—88-05, pp 13-18) **New regulation on the general conditions of sale and delivery of radioactive materials.** 1988. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780048/JAW.

In Report of the National Board of Nuclear Safety and Radiation Protection.

The various articles of the Regulation on the General Conditions of Sale and Delivery of Radioactive Materials which entered into force on 1 March 1988 are discussed taking into account the Atomic Energy Act of 8 December 1984 and the Ordinance on the Implementation of Atomic Safety and Radiation Protection of 11 October 1984.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

REFER ALSO TO CITATION(S) 13927

0702 Radiation Sources

12747 **(BNL—42079) Pulsed-neutron production at the Brookhaven 200-MeV linac.** Ward, T.E.; Alessi, J.; Brennan, J.; Grand, P.; Lankshear, R.; Montemurro, P.; Snead, C.L. Jr.; Tsoupas, N. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 7p. (CONF-8810182—11). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005664/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

The new 750-kV RFQ preinjector and double chopper system capable of selecting single nanosecond micropulses with repetition rates of 0.1--20 MHz has been installed at the Brookhaven 200-MeV proton linac. The micropulse intensity is approximately 1 x 10^9 p/μpulse. Neutron time-of-flight path lengths of 30--100 meter at 0{degree}, 12{degree}, 30{degree}, 45{degree}, 90{degree} and 135{degree} are available, as well as a zero degree swinger capable of an angular range of 0--25{degree}. Pulsed neutron beams of monoenergetic ($p^7Li \rightarrow n^7Be$) and spallation ($p^{238}U \rightarrow nx$) sources will be discussed in the present paper, as well as detailing the chopped-beam capabilities. 11 refs., 5 figs., 1 tab.

12748 (INIS-SU—12, pp 38-40) **Experience of development and application of average-frequency meters in radioisotope instrument making.** Bunzh, Z.A.; Vejde, A.A.; Tesnovo, Eh.R. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

Different modifications of digital average-frequency meters (AFM) designed for operating together with radioisotope thickness gauges for random inspection and continuous control are considered. A quartz generator, time meter, counting ratemeter, decorder, and a control unit are the main parts of AFM. A storage register is introduced into AFM for thickness gauges of continuous control. Metrological characteristics of thickness gauges and performances of digital AFM are given.

08 Production

REFER ALSO TO CITATION(S) 12777

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 13559

12749 **(AD-A—199807/9/XAB) Carbon monoxide and carbon dioxide hydrogenation catalyzed by supported ruthenium carbonyl clusters: a novel procedure for encapsulating $Ru_3(Co)_{12}$ within the pores of Na-Y zeolite. Technical report No. 1, 1986-1987.** Hastings, W.R.; Cameron, C.J.; Thomas, M.J.; Baird, M.C. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Chemistry). 1988. 8p. NTIS, PC A02/MF A01.

Pub. in Inorganic Chemistry, Vol. 27, No. 17, 3024-3028(1988).

Zeolite-supported ruthenium catalysts for the hydrogenation of carbon monoxide and carbon dioxide were prepared by sorbing $Ru(CO)_5$ (molecular diameter 6.3 A) onto Na-Y zeolite and Linde 5A molecular sieve. Although the metal carbonyl is not absorbed into the pores of the molecular sieve (diameter 4.2 A), it is readily absorbed into the pores (diameter 7.4 A) and supercages (diameter 13 A) of the Na-Y zeolite. The Ru(CO)5 in Na-Y coverts in the absence of carbon monoxide to the much larger Ru3(CO)12 (diameter 9.2 A), which remains on the surface of the molecular sieve but is trapped within the supercages of the Na-Y zeolite because it cannot pass through the smaller pores. Slow, temperature-programmed heating of the Ru3(CO)12 in Na-Y to 350 C under a flow of hydrogen results in decarbonylation and formation of a CO hydrogenation catalyst that produces a very atypical (for ruthenium) hydrocarbon distribution truncated at about C10. The unusual product distribution presumably arises because the catalyst sites are situated within the zeolite supercages. Thus the metal is highly dispersed and or the growing hydrocarbon chains are subject to geometrical limitations on their growth. Consistent with this prothesis, ruthenium carbonyl clusters immobilized on the external surfaces of Na-Y zeolite, Linde 5A molecular sieve, and gamma alumina all exhibit typical, nonselective hydrocarbon-product distributions.

12750 **(CONF-870364—6) Gasification of RDF [refuse-derived fuel] in a pressurized fluidized bed.** Onischak, M.; Knight, R.A.; Evans, R.J.; Babu, S.P. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 19p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI88017155/JAW.

From 11. IGT conference on energy from biomass and wastes; Orlando, FL, USA (16 Mar 1987).

The pressurized thermal gasification of refuse-derived fuel (RDF), provides an alternative option to the current available municipal solid waste (MSW) disposal methods. A pressurized fuel gas from RDF offers a flexible product in terms of distribution, use, and environmental control benefits and eventually, a combined-cycle power generation. RDF gasification process research began at IGT in a process development unit (PDU) with an exploratory test of pressurized, fluidized-bed gasification conducted at 300 psig and 1450{degree}F at a feed rate of about 800 lb/h. These test re-

sults under air-blown conditions are presented in detail: the gas yield composition and the condensible liquid yield and composition. Analysis of the initial pressurized gasification test and a thermobalance decomposition test of the RDF feedstock indicated that the RDF char carbon was not completely converted under the test conditions. Changes in the process operating conditions are suggested to achieve complete carbon conversion in the single-stage, fluidized-bed gasifier. In developing a broad and sound technology base on pressurized RDF gasification, a variety of RDF feedstocks need to be tested with process information gathered for gas cleanup, ash disposal, and process control in response to short-term feed variation. 3 refs., 5 figs., 3 tabs.

12751 **(DOE/ER/12095—6) Regulation of alcohol fermentation in Escherichia coli: [Final] progress report, July 1985--June 1988.** Clark, D.P. (Southern Illinois Univ., Carbondale (USA). Dept. of Microbiology). 1988. Contract AC02-82ER12095. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006406/JAW.

This report describes progress in research on the biochemical degradation of alcohols by genetically modified bacteria. Topics include the genetics of the adh system, the characterization of the ADH/ACDH protein, the regulation of the adh gene, the isolation of two lactate dehydrogenase mutants, mutations that affect anaerobic growth, and regulation of the anaerobic gene fusions. (TEM)

12752 **(DOE/ER/13241—1) Genetics of the methanogenic bacterium, Methanococcus voltae, with attention to genetic control mechanisms: Progress report, January 15, 1988--January 14, 1989.** Konisky, J. (Illinois Univ., Urbana (USA). Dept. of Microbiology). 1 Feb 1989. Contract FG02-84ER13241. 3p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006249/JAW.

The overall objective of our program is to both develop a genetic system and understand mechanisms of gene expression for the methanogen, Methanococcus voltae. During the past year we have made progress in several areas. During the last several months, we have had very promising results with regard to the utilization of electroporation for the introduction of DNA into Mc.voltae. In summary, we have been able to demonstrate an approximately 2 to 5 fold increase in transformation via electroporation as compared to the frequency obtained via natural transformation. In the coming year, we intend to further optimize this system and to make a serious effort to introduce plasmid and VLP genome DNA. In our efforts to characterize gene expression in methanogens, we have collaborated with T. Demarco and Ralph Wolfe in cloning an enzyme of the C1 cycle. To catalyze the interconversions mediated by the novel coenzymes of methanogenesis, several enzymes exist which have no common analog in non-methanogenic bacteria. One of these enzymes, formylmethanofuran: tetahydromethanopter in fiormyltransferase was cloned into E. coli HB101. Methanobacterium thermoautotrophicum (H) DNA digested with BAM H1 was ligated into pBR329 and probed with a synthetic oligonucleotide directed against the portion of the gene encoding the amino terminus of the enzyme. The cloned 5.0-kilobase genomic insert contained the entire gene for this polypeptide as well as 200 bp of the upstream region. A ribosome binding site just upstream of the initiation codon was identified, however a promoter was not clearly visible owing to the naturally high A plus T content of this intergenic region. 4 refs.

12753 **(DOE/PC/40275—T2) Combustion characteristics of synthetic liquid fuels: Final report.** Beer, J.M. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jul 1986. Contract AC22-81PC40275. 183p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE86014712/JAW.

The objective of this project was to obtain experimentally information on fuel-nitrogen transformation, soot formation, and combustion of soot in synthetic fuel flames and to develop corresponding analytical models and scale-up criteria needed to design industrial combustion devices to use synthetic liquid fuels in an efficient and environmentally acceptable manner towards this objective. SRC-II fuel was combusted, and measurements were taken in staged and unstaged flames. The project was planned as comprising three project elements. However, the decision to terminate all DOE-funded synfuels-related research meant that almost all of the work on the project ended after 12 months. Some restructuring of the program plan was carried out to maximize the usefulness of the curtailed database, but it was in no way possible to capitalize on the synergy of the inter-related project elements, and the results are therefore divided into the three elements for reporting purposes. 31 refs., 32 figs., 12 tabs.

12754 **(PB—89-131163/XAB) Methane activation by metals and semiconductors. Molecular orbital theory. Annual report, September 1987-August 1988.** Anderson, A.B. (Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Chemistry). Sep 1988. 66p. NTIS, PC A04/MF A01.

See also PB—88-142153.

An atom-superposition and electron delocalization molecular orbital study was made of CHn and CO reactions over coordinatively unsaturated Mo(IV) edge cations in MoS_2. Coupling to C_2H6 and $C_2H5(a)$ proceed with high barriers. $CH_2(a)$ coupling to strongly adsorbed ethylene proceeds with a lower barrier, and hydrogenation to ethane is possible. CO binds relatively weakly to 5-fold coordinated Mo and strongly to 4-fold coordinated sites. Over two such sites, CO easily tilts to a di-Sigma bridging orientation and dissociates with a low barrier. In the Fischer-Tropsch process hydrogenation to $CH_3(ads)$ and $H_2O(g)$ is expected. CO inserts into the Mo-CH_3 bond with a low barrier, and subsequent hydrogenations to form C_2H6+H_2O or CH_3CH_2OH are favorable. It is proposed that the selectivity toward alcohol formation over alkali-doped MoS_2 (the DOW process) may stem from the ability of the alkali cations to stabilize alkoxy intermediates. A second molecular orbital study shows AlN behaves similarly to MgO toward CH_4. Stoichiometric AlN is inactive. CH_4 is activated by surface N(2-) hole sites, forming surface HN(2-) and methyl radicals.

12755 **(PB—89-131171/XAB) Novel catalytic materials for methane activation and selective oxidation of hydrocarbons. Annual report, September 1987-August 1988.** Schwank, J. (Michigan Univ., Ann Arbor (USA). Dept. of Chemical Engineering). 23 Sep 1988. 20p. NTIS, PC A03/MF A01.

This report summarizes the results of the second year of a three-year research program aimed at fundamental investigations of catalytic methane activation. The catalyst included supported and unsupported molybdenum and tungsten oxides. The blank activity of various oxide supports has been studied. Also, the effect of traces of ethane in the feedstream and of passivating the supports or reactor walls with boric acid has been investigated. Modification of catalytically active oxides by adding a second component allowed adjustment of the oxygen-transfer capability of the surfaces, and thus influenced the selectivity towards partial oxidation products, such as formaldehyde.

12756 **(PB—89-133771/XAB) Demonstration of landfill-gas enhancement techniques in landfill simulators. Final report. Report for February 1980-January 1985.** Stamm, J.; Vogt, G.; Walsh, J. (SCS Engineers, Inc., Covington, KY (USA)). May 1985. 166p. NTIS, PC A08/MF A01.

See also DE83003631.

Various techniques to enhance gas production in sanitary landfills were applied to sixteen landfill simulators. These techniques included accelerated moisture addition, leachate recycle, buffer addition, nutrient addition, and combinations of these variables. Each test cell contained approximately 380 kilograms of municipal solid waste and selected cells received quantities of buffer and nutrient compounds. All simulators were constructed in February 1980 and monitoring continued for three years. After the third year, selected cells were reloaded with sludge, nutrient, or buffer slurries to further promote gas generation. Numerous physical and chemical parameters were measured to determine gas-production rates and quality and leachate volumes and composition. The report presents results from all five years of project operations. Results from the study indicate that sewage-sludge additions, buffer additions, and nutrient additions each appear to be successful enhancement techniques for gas production from municipal solid waste.

12757 (SAND—88-7110) Direct methane conversion: An assessment. Gray, D.; Tomlinson, G. (Sandia National Labs., Albuquerque, NM (USA); Mitre Corp., McLean, VA (USA). Civil Systems Div.). Dec 1988. Contract AC04-76DP00789. 64p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005303/JAW.

This report documents technical analyses of the following direct methane conversion approaches: oxidative coupling, partial oxidation and oxyhydrochlorination. System efficiencies are compared to the performance of conventional steam reforming, methanol synthesis and Mobil's methanol-to-gasoline process. Partial oxidation and oxidative coupling are shown to offer lower heating value conversion efficiencies comparable to that achieved with conventional technology, and may offer economic advantages by eliminating steam reforming. Oxyhydrochlorination offers improved efficiency, but may be economically impractical because of material problems. 28 refs., 15 figs., 11 tabs.

12758 Conditional probability density functions measured in turbulent nonpremixed flames of methane near extinction. Masri, A.R.; Bilger, R.W. (Dept. of Mechanical Engineering, Univ. of Sydney, NSW 2006 (AU)); Dibble, R.W. (Combustion Research Facility, Sandia National Labs., Livermore, CA (US));. *Combustion and Flame;* **74**: No. 3, 267-284(Dec 1988).

Spontaneous Raman-Rayleigh measurements of temperature and species concentrations have been made in turbulent nonpremixed flames of methane close to extinction. For each data point, five different values of reactedness are calculated from the measured temperature and the mass fractions of CH/sub 4/, O/sub 2/, H/sub 2/O and CO/sub 2/. These data are then sampled with respect to five ranges of mixture fraction and the conditional single and joint probability density functions (PDFs) of reactedness calculated from the various reactive scalars are presented for each range. Conditional means and root mean squares (rms) of fluctuations of reactedness, temperature, and species mass fractions are also presented. It is found that for mixture fraction ranges lying below the rich reaction limit, $\xi < \xi$/sub R/ (ξ/sub R/ = 0.087 for methane) combustion is generally bimodal and fluid samples are either fully burned or unburned. For ranges with $\xi > \xi$/sub R/, the majority of mixtures are partially reacted and the conditional PDFs have centered distributions. The correlation between the conditional PDFs of various reactive scalars indicate that more than a single-step reaction mechanism is required to adequately describe the chemistry. Close to extinction, the flame was kept alight by fully burned pockets of fluid that provide a source of reignition for mixtures with slower mixing rates. The flame blows off when the frequency of occurrence of these pockets becomes small.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 12751, 12763, 12769

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 12763

13 HYDRO ENERGY

1301 Resources And Availability

12759 (AD-A—199717/0/XAB) Objective analysis of the Gulf Stream thermal front: methods and accuracy. Technical report. Tracey, K.L.; Friedlander, A.I.; Watts, R. (Rhode Island Univ., Kingston (USA). Graduate School of Oceanography). Dec 1987. 112p. (GSO-TR—87-2). NTIS, PC A06/MF A01.

The objective-analysis (OA) technique was adapted by Watts and Tracey in order to map the thermal frontal zone of the Gulf Stream. Here, the authors test the robustness of the adapted OA technique to the selection of four control parameters: mean field, standard deviation field, correlation function, and decimation time. Output OA maps of the thermocline depth are most affected by the choice of mean field, with the most-realistic results produced using a time-averaged mean. The choice of the space-time correlation function has a large influence on the size of the estimated error fields, which are associated with the OA maps. The smallest errors occur using the analytic function based on 4 years of inverted echo sounder data collected in the same region of the Gulf Stream. Variations in the selection of the standard deviation field and decimation time have little effect on the output OA maps. Accuracy of the output OA maps is determined by comparing them with independent measurements of the thermal field. Two cases are evaluated: standard maps and high-temporal-resolution maps, with decimation times of 2 days and 1 day, respectively. Standard deviations (STD) between the standard maps at the 15% estimated error level and the XBTs (AXBTs) are determined to be 47-53 m. Comparisons of the high-temporal-resolution maps at the 20% error level with the XBTs (AXBTs) give STD differences of 47 m.

1306 Environmental Aspects

12760 (AD-A—200562/7/XAB) Predicted effects of hydropower uprate on trout habitat in the Cumberland River, Downstream of Wolf Creek Dam, Kentucky. Final report. Nestler, J.M.; Gore, J.A.; Curtis, L.T.; Martin, J.L. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab.). Aug 1988. 143p. (WES/MP/EL—88-10). NTIS, PC A07/MF A01.

The US Army Engineer District, Nashville (ORN), regulates flows in the Cumberland River at Wolf Creek Dam to provide for hydropower generation and flood control. The ORN is considering uprating the Wolf Creek Dam powerhouse to meet future demands for power in the region by replacing existing turbines with new units having higher capacity. With the proposed new units, maximum hydropower discharge will increase with a concomitant decrease in duration of generation. This report describes and quantifies the effects of hydropower uprating on downstream habitat of adult rainbow trout, juvenile brown trout, and adult brown trout using Instream Flow Incremental Methodology concepts. The relative downstream habitat impacts of hydropower uprate are assessed by contrasting existing and uprate release schedules under the following three hydrologic conditions: low flow (90% exceedance), average flow (50% exceedance), and high flow (10% exceedance). In general, predicted habitat availability for adult rainbow trout and adult brown trout decreases under uprate release schedules for low- and average-flow hydrologic conditions. Under high-flow conditions, habitat availability for the adult-life stages increases. Habitat for juvenile brown trout is generally negligible under both existing and uprate release schedules, and consistent patterns were not observed.

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 13003

1401 Resources And Availability

12761 (TNO-TPD—314.226-3) Validation of solar radiation models and recommendation of the model for Dutch climatological circumstances. Van den Brink, G.J. (Nijverheidsorganisatie TNO, Delft (Netherlands). Technisch Physische Dienst). Sep 1987. 149p. Technisch Physische Dienst TNO-TH, P.O. Box 155, 2600 AD Delft, Netherlands.

For computer calculations concerning active and passive solar energy systems, the solar irradiance on several different oriented tilted surfaces, has to be known. Since only few measurements are made for the non-horizontal surfaces, models have to be used for the calculation. The accuracy of several models has been investigated for the Dutch climatological circumstances by means of an extensive validation procedure. This procedure includes the testing of the accuracy per year, month and hour, in dependence of sunshine duration and the influence of the models on the solar contribution to the heat demand of several systems using solar energy in an active and passive way. The model which showed to have the highest accuracy in the present study was a new model by Perez,

which according to his own publication is a more accurate and considerably simpler version of his earlier diffuse irradiance model, which had been proven to be accurate within IEA task IX of the IEA solar heating and cooling programme. Due to communication problems the old version has not been validated in the present study. The new simplified Perez model is now recommended for use in the Netherlands. 1 fig., 22 refs., 29 tabs.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 12750, 12751, 12752, 12756, 13077, 13197, 13259, 13490

12762 **(AD-A—200227/7/XAB) Microprocessor-based, solar-cell-parameter measurement system. Master's thesis.** Oxborrow, R.R. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1988. 89p. NTIS, PC A05/MF A01.

The effects of the space environment on solar cells has, to date, been largely modeled and approximated in the design of solar arrays. Restrictions such as weight and cost have precluded direct analysis of the long-term effects of radiation in space. At the Naval Postgraduate School (NPS), a simple circuit has been devised that facilitates in-situ data collection and analysis of these effects. The circuit includes an op-amp and a high-beta transistor for cell voltage biasing. When coupled to a microprocessor-based controller system, this circuit has the capability to measure and store data pertaining to solar-cell performance I-V curves. The complete system consists of an NSC 800 microprocessor, D/A and A/D components, analog multiplexers and demultiplexers, biasing transistors and op-amps. This design provides a compact, low power, accurate method for I-V measurement and data storage. Such a system may be used to observe and monitor an array of test cells and their performance degradation in both the space environment and terrestrial applications.

12763 **(CONF-880215—6) Panel discussion on the relative merits of woodgrass and SRIC [short-rotation intensive culture].** Wright, L.L.; DeBell, D.S.; Strauss, C.H.; Geyer, W.A.; Sennerby-Forsse, L.; Zsuffa, L.; White, E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005345/JAW.

From Energy from biomass and wastes; New Orleans, LA, USA (15 Feb 1988).

A debate on the relative merits of woodgrass versus short-rotation intensive culture (SRIC) as alternative biomass-energy-feedstock production systems was organized via two vehicles: (1) a panel discussion that was held immediately following the presentation of papers in the woodgrass and SRIC sessions of the IGT conference and (2) a questionnaire prepared after the meetings to obtain informed, written opinions from the panelists on the relative merits of woodgrass and SRIC. Highlights of the panel discussion are briefly summarized. The major portion of this document consists of four questions prepared by the author and the responses by the coauthors of this paper. The summary presents the first author's opinion after consideration of all responses. 3 refs.

12764 **(N—89-12121) Results of the 1988 NASA/JPL balloon flight solar cell calibration program.** Anspaugh, B.E.; Weiss, R.S. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1988. 39p. (NASA-CR—182998; JPL-PUB—88-36; NAS—1.26:182998). NTIS, PC A03/MF A01.

The 1988 solar cell calibration balloon flight was successfully completed on August 7, 1988, meeting all objectives of the program. Forty-eight modules were carried to an altitude of 118,000 ft (36.0 km). The calibrated cells can now be used as reference standards in simulator testing of cells and arrays.

12765 **(PB—89-115877/XAB) Bioconversion of plant raw materials by microorganisms.** Oksanen, J. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1988. 208p. (VTT/SYMPOSIUM—88). NTIS, PC E08/MF A01.

The collaboration between the USSR and Finland in the research on the biotechnical utilization of ligno-cellulosic materials is well established. It started already in 1982 under the Treaty between the Academy of Finland and the USSR Academy of Sciences. The authors have arranged a number of joint Seminars for the exchange of information and new ideas. This, as well as the exchange of visiting scientists has proved fruitful.

12766 **(PB—89-127716/XAB) Inventory of biomass facilities in Illinois.** Troxell, D.L. (Great Lakes Regional Biomass Energy Program, Madison, WI (USA)). Oct 1988. 73p. NTIS, PC A04/MF A01.

This report is a completion of operating statistics on biomass energy facilities that were operating or under construction during the duration of the study. The report is organized into separate sections for alcohol-production facilities, methane-production facilities, waste-to-energy incineration facilities, wood-energy facilities, and agricultural-residue combustion facilities. An index by location(county) is provided.

12767 **(PB—89-131098/XAB) Advanced concepts in biomass production and biological pretreatment. Annual report, April 1987-March 1988.** Hiler, E.A.; Miller, F.R.; McBee, G.G.; Boyle, M.; Boyer, J. (Texas Agricultural Experiment Station, College Station (USA)). Apr 1988. 221p. NTIS, PC A10/MF A01.

The overall objective of the research is to investigate fundamental processes for enhancing the efficiency of methane from sorghum systems. The report provides specifics of research activities in the Texas A&M biomass and biological pretreatment program sponsored by Gas Research Institute and co-funded by Texas Agricultural Experiment Station. Five research groups, each with specific tasks are involved in the project: biomass production, quantity and quality; plant water stress; biological pretreatment and processing; long-term effects of land application of digester effluent; and crop-growth modeling, economics, and systems. Also included is the final report on Electrochemistry for the In-Situ Detection of Volatile Acids in Anaerobic Digesters.

12768 **(RUU-NSS—86-39) Solar cells energy recovery. An overview.** Alsema, E.A.; Turkenburg, W.C. (Rijksuniversiteit Utrecht (Netherlands). Fysisch Lab.). Nov 1986. 63p. (In Dutch). Fysisch Laboratorium der Rijksuniversiteit Utrecht, P.O. Box 80000, 3508 TA Utrecht, Netherlands.

An overview is given of the state of the art in solar cell technology. Future developments for the years 1990-1995 in the field of photovoltaics are considered. In particular photovoltaic systems connected to the grid for the Dutch situation are discussed. First some aspects of a photovoltaic system are dealt with as well as characteristics of such a system. Then applications of solar cells and consequences of these applications are discussed. Subsequently the availability of solar energy in the Netherlands is highlighted. Finally the matter of operating cost, investments, energy expenses, kWh prices and potential is dealt with. 18 figs., 38 refs., 4 tabs., 1 app.

12769 **(SERI/SP—231-3245) FY 1987 biochemical conversion/alcohol fuels program: Annual report.** (Solar Energy Research Inst., Golden, CO (USA)). Nov 1988. Contract AC02-83CH10093. 531p. NTIS, PC A23/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000831/JAW.

Ethanol, a high-octane liquid fuel compatible with today's transportation system, can be produced by biological processes from lignocellulosic feedstocks. The Biochemical Conversion/Alcohol Fuels Research Program managed by the Solar Energy Research Institute (SERI) for the US Department of Energy's Biofuels and Municipal Waste Technology Division carries out a program of research and development with the goals of developing processes for converting lignocellulosic materials to ethanol and other fuels in an efficient and cost-effective manner, and facilitating the adoption of these processes by industry. This annual report for FY 1987 summarizes the state of the art and the research conducted by the Biochemical Conversion/Alcohol Fuels Research Program in the past year. The appendices contain detailed descriptions of the individual research projects, organized into the following categories: Acid Hydrolysis, Enzymatic Hydrolysis, Xylose Fermentation, and Lignin Conversion.

12770 (SERI/STR—211-3374) Research on high-efficiency, multi-gap, multijunction, amorphous-silicon-based alloy thin-film solar cells: Phase 1 semiannual subcontract report, 1 March 1987--31 August 1987. Guha, S. (Solar Energy Research Inst., Golden, CO (USA); Energy Conversion Devices, Inc., Troy, MI (USA)). Aug 1988. Contract AC02-83CH10093. 91p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000844/JAW.

The research program described in this report is directed toward advancing our understanding of amorphous-silicon-based alloys and their use in small-area multijunction solar cells. Its principal objectives are (1) to develop a broad scientific base for the chemical, structural, optical, and electronic properties of a-Si based alloys; (2) to determine the optimum properties of alloys materials as they relate to high-efficiency cells; (3) to determine the optimum device configuration for multijunction cells; and (4) to demonstrate a proof-of-concept multijunction a-Si alloy-based solar cell having an efficiency of 18% under standard AM1.5 global insolation conditions and having an area of at least 1 cm^2. This semiannual report describes some of the research results obtained in Phase I. 20 refs., 37 figs., 10 tabs.

12771 (SERI/STR—211-3375) Task B: Research on stable, high-efficiency, large-area, amorphous-silicon-based submodules: Semiannual subcontract report, 1 February 1987--31 July 1987. Carlson, D.E.; Arya, R.R.; Bennett, M.S.; Catalano, A.; D'Aiello, R.V.; Dickson, C.R.; Fortmann, C.M.; Goldstein, B.; Morris, J.; Newton, J.L. (Solar Energy Research Inst., Golden, CO (USA); Solarex Corp., Newtown, PA (USA). Thin Film Div.). Jul 1988. Contract AC02-83CH10093. 143p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000843/JAW.

This semiannual report presents results of research on stable, high-efficiency, large-area, amorphous-silicon-based submodules. High conversion efficiencies (up to 11.95%) were obtained in small-area, single-junction, a-Si solar cells by using textured tin oxide, superlattice p-layers, graded carbon concentrations near the p-i interface, and highly relective ITO/silver back contacts. Researchers also fabricated single-junction a-SiC and a-SiGe p-i-n cells with efficiencies of 9%--11%. Stacked-junction cells of a-SiC/a-Si, a-SiC/a-SiGe, and a-SiC/a-Si/a-SiGe were fabricated, and efficiencies of about 10% were achieved in some of them. Boron-doped microcrystalline SiC films were developed that contain up to 6 at.% C with conductivities of 3 {times} 10/sup {minus}3/ ohm /sup {minus}1/ cm/sup {minus}1/ at room temperature and activation energies of 0.11 eV. Stability studies showed that light-induced degradation is usually enhanced by the presence of C grading near the p-i interface. Light-induced degradation of the fill factor of p-i-n cells strongly correlates with optical absorption at 1.2 eV, as measured by photothermal deflection spectroscopy. 11 refs., 70 figs., 16 tabs.

12772 (SERI/STR—211-3407) Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 2 Semiannual subcontract report, 1 February 1985--31 July 1985. Carlson, D.E.; Ayra, R.R.; Bennett, M.S.; Catalano, A.W.; D'Aiello, R.V.; Dickson, C.R.; Newton, J.L.; O'Dowd, J.G.; Oswald, R.S. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1988. Contract AC02-83CH10093. 60p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000847/JAW.

This report presents results of the second phase of research in high-efficiency, single-junction, monolithic, thin-film a-Si solar cells. Five glow-discharge deposition systems, including a new in-line, multichamber system, were used to grow both doped and undoped a-Si:H. Strong correlations were found between the breakdown voltage, the deposition rate, and the diffusion length for varying cathode-anode separations in a DC glow-discharge deposition mode. Tin oxide films were grown by chemical vapor deposition using either tetramethyl tine (TMT) or tin tetrachloride (TTC). The best films were grown with TMT, but those grown with TTC had a more controlled texture for light trapping and provided a better contact to the p-layer. Tests indicated that Ti/Al provides a stable, low-resistance back metal contact. Efficiencies of more than 10% were obtained with a p-i-n structure in which a thin, undoped a-Si:C:H layer is first deposited on the tin-oxide-coated glass. The stability of a-Si:H cells was improved by light doping of the i-layer, but the doping also caused a loss in initial performance. A new baseline submodule was designed and an active-area (350 cm^2) efficiency of 6.7% was obtained. An active-area (82.5 cm^2) efficiency of 6.7% was also obtained with laser scribing techniques. 7 refs., 31 figs., 7 tabs.

12773 Effects of thickness and sintering conditions of CdS films on the photovoltaic properties of CdS/CdTe solar cells. Jun, Y.K.; Im, H.B. (Dept. of Materials Science and Engineering, Korea Advanced Institute of Science and Technology, Cheongryang, Seoul (KR));. *Journal of the Electrochemical Society;* **135**: No. 7, 1658-1661(Jul 1988).

Sintered CdS films with various thicknesses and electronic properties have been prepared by changing the coated thickness and sintering conditions. All-polycrystalline CdS/CdTe solar cells have been fabricated by coating a CdTe slurry on the sintered CdS films and sintering in an attempt to optimize the thickness and conditions of CdS film whose role is to be the window as well as the front contact for the CdS/CdTe solar cell. Optical transmission of the sintered CdS film shows a maximum value for 25 μm thick films when the films were sintered at 650°C for lh in nitrogen whereas the maximum optical transmission is observed in 15 μ thick film when the films were sintered at 600°C. The highest optical transmission is observed in 12 μm thick CdS film which was sintered at 560°C. Electrical resistivity of the sintered CdS films was less than 1 Ω-cm. Solar efficiency of 11.2% was observed in all-polycrystalline CdS/CdTe solar cell that was fabricated on the 12 μm thick CdS film.

12774 Advanced optical materials for energy efficiency and solar conversion. Lampert, C.M. (California Univ., Berkeley (USA)). pp 277-346 of Physics and technology of solar energy. Volume 2. Photovoltaics and solar energy materials. Garg, H.P.; Dayal, M.; Furlan, G.; Sayigh, A.A.; Sharma, V.K. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1987). (CONF-8611273—).

From International workshop on physics of solar energy; New Delhi, India (24 Nov 1986).

Optical materials and coatings play an important role in determining the efficiency of solar conversion processes. At present the best known coatings are heat mirrors, selective absorbers, and reflector materials. There are, however, many less known coatings and materials, some of which are under current research and development. These films and materials are known as antireflective coatings or treatments, fluorescent concentrator materials, holographic films, cold mirrors, radiative cooling surfaces, optical switching films, and transparent insulation materials. The use of such films and materials improves the efficiency and stimulates innovation in passive and active solar energy conversion, photovoltaics, energy-efficient windows, and many hybrid designs. The present study is intended to instruct readers on the properties of solar energy materials, and their function, as well as advantages and limitations. It is also materials, techniques, and concepts that can manipulate solar energy into the forms of heat, light, and electrical power. The materials stability requirements for effectively collecting and transmitting solar energy are extremely demanding. This combined with the need for inexpensive production methods creates a very broad area for innovative scientific research. 40 figs., 133 refs., 6 tabs.

12775 Hydrogen ion beam passivation of electrically active defects in crystalline silicon solar cells. Tsuo, Y.S.; Milstein, J.B.; Matson, R.J. (Solar Energy Research Institute, Golden, CO (US));. pp v of Ion beam processes in advanced electronic materials and device technology. Appleton, B.R.; Eisen, F.H.; Sigmon, T.W. Pittsburgh, PA; Materials Research Society (1985). (CONF-850421—).

From 2. spring meeting of the Materials Research Society; San Francisco, CA, USA (15 Apr 1985).

The authors have observed significant improvements in the efficiencies of dendritic web and edge-supported-pulling silicon sheet solar cells after hydrogen ion beam passivation for a period of ten minutes or less. They have obtained electron-beam-induced current data that show the hydrogen passivation of dislocations as well as grain boundaries in edge-supported-pulling silicon sheet solar cells. They have studied the effects of the hydrogen ion beam treat-

ment with respect to silicon material damage, silicon sputter rate, introduction of impurities, and changes in reflectance.

1406 Photovoltaic Power Systems

12776 **(AD-A—200009/9/XAB) Comparison of photovoltaic energy systems for the solar village. Master's thesis.** Pierce-French, E.C. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). Aug 1988. 167p. (AFIT/CI/NR—88-184). NTIS, PC A08/MF A01.

Three different solar photovoltaic (PV) energy systems are compared to determine if the electrical needs of a solar village could be supplied more economically by electricity generated by the sun than by existing utility companies. The solar village, a one square mile community of 900 homes and 50 businesses, would be located in a semi-remote area of the Arizona desert. A load survey is conducted and information on the solar PV industry is reviewed for equipment specifications, availability, and cost. Three specific PV designs, designated as Stand-Alone, Stand-Alone with interconnection, and Central Solar Plant, were created and then economically compared through present worth analysis against utility supplied electrical costs. A variety of technical issues, such as array protection, system configuration and operation, and practicability, are discussed for each design. The present-worth analysis conclusively shows none of the solar PV designs could supply electricity to the solar village for less cost than utility-supplied electricity, all other factors being equal. No construction on a solar village should begin until the cost of solar-generated electricity is more competitive with electricity generated by coal, oil, and nuclear energy. However, research on ways to reduce solar PV equipment costs and on ways to complement solar PV energy, such as the use of solar thermal ponds for heating and cooling, should continue.

12777 **(RUU-NSS—87-04) Application of solar cells for the Dutch electric power supply up to 2050.** Alsema, E.A.; Blok, K.; Ter Horst, E.W.; Turkenburg, W.C. (Rijksuniversiteit Utrecht (Netherlands). Fysisch Lab.). Feb 1987. 62p. (In Dutch). Fysisch Laboratorium der Rijksuniversiteit Utrecht, P.O. Box 80000, 3508 TA Utrecht, Netherlands.

The contribution of photovoltaic technology to the Dutch energy supply for the first half of the next century is indicated. An overview is given of the expected technological and cost price developments after a short description of a photovoltaic system and solar energy supply. Next the bottlenecks at large-scale introduction of photovoltaic systems in the Netherlands are discussed. Starting from certain scenarios for the power supply it is indicated for which production costs photovoltaic systems can compete with conventional methods of power generation. Subsequently the set-up of a generation capacity on the basis of photovoltaic systems in the Netherlands is outlined in an introduction scenario. Also the resulting contribution to the power supply can be determined this way. Finally two options for the photovoltaic energy supply are described. The first option is a photovoltaic system in the Sahara to produce hydrogen which can be transported to the Netherlands to be used as a fuel. The second option is a solar panels equipped satellite system which can transmit generated power to the earth by means of microwave emitters. 9 figs., 63 refs., 15 tabs.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 12784

12778 **(SAND—88-2664) Reliability of the Solar One plant during the power production phase: August 1, 1984--July 31, 1987.** Kolb, G.J.; Lopez, C.W. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1988. Contract AC04-76DP00789. 67p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006365/JAW.

The power production phase at Solar One spanned three years from August 1, 1984 through July 31, 1987. In that period the plant achieved an average availability, during hours of sunshine, of 81.7%. This report presents the frequencies and causes of the plant outages that occurred. The eleven most important causes composed 75% of the total outage time. Qualitative insights related to the origin and mitigation of these causes are provided. Also presented are insights and statistics regarding the reliability of the heliostat field. The quantitative and qualitative information presented in this report will be useful to studies aimed at improving the reliability of future solar central receiver power plants. 20 refs., 11 figs., 3 tabs.

12779 **(SAND—88-7028) A study of the reliability of Stirling engines for distributed receiver systems.** Holtz, R.E.; Uherka, K.L. (Sandia National Labs., Albuquerque, NM (USA); Argonne National Lab., IL (USA)). Nov 1988. Contract AC04-76DP00789;W-31109-ENG-38. 71p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006395/JAW.

The objective of this study was to examine the reliability of existing and improved Stirling engine concepts for dispersed solar dish/electric applications in the 25--50 kW/sub e/ range. Five current kinematic Stirling engine designs have the capability to meet or exceed the 32% system efficiency goal of the DOE Solar Thermal Program. Experience with the Vanguard Solar-Dish/Stirling Engine module demonstrated that the 32% efficiency goal is realistic, but that improved Stirling engine reliability is necessary for successful implementation of dispersed solar power systems. A review of historical Stirling engine data illustrated that the three major reliability issues with kinematic Stirling engines are the piston-rod seals, engine hot parts and power control/drive systems. A specific kinematic engine concept that appears to have the potential for meeting the 50,000-hour operating lifetime requirement of solar power systems has a pressurized crankcase to reduce piston-rod seal problems, an indirectly heated hot-end section using heat pipes to smooth out temperature gradients in the heater tubes, and a variable-angle swashplate for power control. Further development efforts are required to establish reliability and validate performance goals of these engine concepts. 30 refs., 13 figs., 8 tabs.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 13017

12780 **(TNO-TPD—327.224-2) Development of a test method for already operating solar boilers.** Keizer-Boogh, E.M. (Nijverheidsorganisatie TNO, Delft (Netherlands). Technisch Physische Dienst). Apr 1987. 34p. (In Dutch). Technisch Physische Dienst TNO-TH, P.O. Box 155, 2600 AD Delft, Netherlands.

A test method has been developed for the fast testing of solar boiler systems which are in operation for some time. The test is based on the principle of the short term solar boiler test, which is carried out under an artificial sun. The method was simulated with the help of the calculation model whereupon a test was carried out at a functioning system. The measured results and the calculated referential system correspond satisfactorily. 28 figs., 3 refs., 1 tab.

12781 **(TNO-TPD—514.019) Comparison of thermosyphon and forced flow at a solar boiler system.** Van Amerongen, G.A.; Kortschot, D.J.; De Geus, A.C. (Nijverheidsorganisatie TNO, Delft (Netherlands). Technisch Physische Dienst). Apr 1987. 65p. (In Dutch). Technisch Physische Dienst TNO-TH, P.O. Box 155, 2600 AD Delft, Netherlands.

Results of the testing of an active and a thermosiphon solar boiler system are presented. Both systems have been subjected to an 'outdoor' test in the System Test Facility (Technical University, Delft, Netherlands) and an 'indoor' test (a solar simulator). It is concluded that the thermosiphon system gives about 5% higher annual yield than an identical active solar boiler system. The appendices give extended specifications of the solar boilers and the tests. 39 figs., 5 refs., 7 tabs., 1 app.

12782 **(TNO-TPD—614.028) Calculations on a solar boiler with a double storage system (suitable for agricultural purposes).** Schoonewille, H.; Brethouwer, D.E.; Keizer, E.M. (Nijverheidsorganisatie TNO, Delft (Netherlands). Technisch Physische Dienst). Jun 1987. 24p. (In Dutch). Technisch Physische Dienst TNO-TH, P.O. Box 155, 2600 AD Delft, Netherlands.

Results of the calculations as stated in the title are presented. The heating system consists of two heat storage units which can be heated separately. The first calculation is a comparison of a referential system of one storage unit and the concept of two storage units. The energy yield of the referential system is circa 390 kWh/m/sup 2/ and circa 450 kWh/m/sup 2/ for the LZE concept. LZE stands for 'Luigjes Zonne Energie' (Luigjes Solar Energy Company, Voorthuizen, Netherlands). From further optimization it is concluded that the maximum yield improvement is 17%, the operating hours of the collector pump of the referential system amount to circa 1700 hrs and circa 2000 hrs for the LZE system. It is also concluded from the calculations that to a small degree the effect of the extra storage unit is dependent on the extra capacity. For this application a 1-3 m/sup 3/ unit is sufficient. For the calculations a modified TPD simulation model of a solar boiler has been used. 8 figs., 4 refs., 5 tabs., 1 app.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 12774, 12782, 13017

12783 (PB—89-852297/XAB) Solar-energy concentrator design and operation. February 1985-December 1988 (Citations from the NTIS data base). Report for February 1985-December 1988. (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 83p. NTIS PC N01/MF N01.

Supersedes PB—86-861507.

This bibliography contains citations concerning the design and operation of a variety of solar-energy concentrators. Topics include system descriptions, performance evaluations, technology reviews and development studies, cost considerations, and materials aspects. Optical properties of various systems, performance simulations, fabrication techniques, and control systems are discussed. Photovoltaic and thermal systems are considered. (This updated bibliography contains 131 citations, 37 of which are new entries to the previous edition.)

12784 (SAND—87-8025) A description and assessment of heliostat technology. Mavis, C.L. (Sandia National Labs., Livermore, CA (USA)). Jan 1989. Contract AC04-76DR00789. 182p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006001/JAW.

This report summarizes heliostat development through 1986 by the Department of Energy's Solar Thermal Central Receiver Program. It has been prepared to provide potential users and developers of Central Receiver Systems with an assessment and overview of the technology. The topics covered are design descriptions, cost information, operation, maintenance, reliability, cleaning, beam safety, evaluation instrumentation, materials, and future research and development recommendations. 169 refs., 69 figs., 36 tabs.

12785 (SERI/SP—253-3383) Optical goals for polymeric film reflectors. Short, W.D. (Solar Energy Research Inst., Golden, CO (USA)). Oct 1988. Contract AC02-83CH10093. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000836/JAW.

This report provides guidelines and recommendations for research on polymeric film reflectors which have the potential to significantly reduce the weight and cost of concentrators for solar thermal systems. As with glass/metal reflectors, the primary performance criteria for film reflectors are reflectivity and specularity over the life of the film. The recommended reflectivity and specularity goals for polymer reflectors are made in the context of the cost of energy delivered and how that compares to the cost from alternative means of supplying the same energy. However, these optical goals should be considered only as guidelines, since many other parameters such as system capital cost can have a far larger impact on the cost of delivered energy. To ensure that these guidelines are correctly interpreted, the report includes definitions of the terms. The report also provides a summary listing of the recommendations and analysis details on which each recommendation is based. 12 refs., 11 figs., 3 tabs.

12786 (TNO-TPD—527.009) Research on the influence of wind on the energy yields of solar collectors for swimming pool heating. Brethouwer, D.E.; Schoonewille, H.; Keizer-Boogh, E.M. (Nijverheidsorganisatie TNO, Delft (Netherlands). Technisch Physische Dienst). Jul 1987. 62p. (In Dutch). Technisch Physische Dienst TNO-TH, P.O. Box 155, 2600 AD Delft, Netherlands.

During more than one bathing season the energy yields of ten solar collector fields in a swimming pool are determined. Also the acquired climatological and installation-technical variables have been recorded. Based on these data fruitless attempts were carried out to determine the influence of wind on the energy yields of the solar collectors. Some causes of this are indicated. The comparison of different types and installed versions of the collectors, however, led to a result: the low fin efficiency of the strip collectors has a strong adverse influence on the energy yield when they are uncovered. Three installation versions are applicated and described. Also three wind hindering measures have been taken of which one led to a substantial improvement of the energy yield. 28 figs., 5 refs., 4 tabs., 5 apps.

12787 Support and maneuvering device. Wood, R.L. (to Dept. of Energy, Washington, DC). US Patent 4,762,298. 9 Aug 1988. Filed date 23 Mar 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This paper describes a support and maneuvering device securable to a ground surface and adapted for mounting a mechanism to receive solar energy from the sun. The device consists of: a. flexible, inflatable enclosure having a fixed end and a movable end, the movable end of the enclosure being collapsible toward the fixed end to a contracted position when the enclosure is in a noninflated condition, and the movable end being movable away from the fixed end to an extended position when the enclosure is in an inflated condition; b. means for mounting the solar energy receiving mechanism to the movable end; c. means for inflating the enclosure to any selected position between the contracted position and a fully extended position; d. at least three position controlling means disposed about the movable end to adjust the movable end in conjunction with the inflation means by predetermined amounts to control the angle and attitude at which the solar energy receiving mechanism is oriented relative to the position of the sun and the ground surface, the position controlling means limiting a number of degrees of freedom of the movable end to continuously control the angular position thereof; and e. at least two of the position controlling means comprising adjustable, position controlling means each adjustable position controlling means being connected to different corresponding portions of the movable end.

1420 Heat Storage

REFER ALSO TO CITATION(S) 12782

15 GEOTHERMAL ENERGY

1501 Resource Status And Assessment

12788 (EGG-M—88421) Status and trends of geothermal direct use projects in the United States. Lunis, B.C.; Lienau, P.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 5p. (CONF-881045—6). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005417/JAW.

From Annual meeting of the Geothermal Resources Council; San Diego, CA, USA (9 Oct 1988).

The United States is continuing to experience a significant growth rate in the use of low- and moderate-temperature geothermal resources for direct use applications, which is making an increasing contribution to the United States energy demands. This paper provides an overview of how and where geothermal energy is being used, the extent of that use, and what the development trends and concerns appear to be. The applications discussed include industrial processes, heat pumps (heating and cooling), pools

and spas, aquaculture and agriculture applications, and space and district heating projects. 3 tabs.

12789 **(PB—89-124192/XAB) Mineral resources of the Henry's Lake Wilderness Study Area, Fremont County, Idaho.** Tysdal, R.G.; Kulik, D.M.; Peters, T.J. (Geological Survey, Alexandria, VA (USA)). 10 Jun 1988. 28p. (USGS-BULL—1718-D). NTIS, PC A03/MF A01.

Also available from Supt. of Docs. Library of Congress catalog card no. 88-600296. Color illustrations reproduced in black and white.

A mineral-resource survey of the 350-acre Henry's Lake Wilderness Study Area (ID-035-077) was made in 1986-87. No identified resources (known) or currently active claims exist within or adjacent to the wilderness study area. There is potential for several types of undiscovered mineral resources within the study area. The southwestern part of the wilderness study area, along the Madison Range fault, is rated as having a moderate energy-resource potential for geothermal water; the remainder of the study area has a low potential for resources of this commodity. A small outcrop of marble in the southernmost part of the study area has a low mineral-resource potential for talc; for talc in marble possibly concealed beneath the study area the mineral-resource potential is rated as unknown. The study area has a low mineral-resource potential for iron in hematite-mineralized amphibolite gneiss, and for gold, silver, and uranium. The area has no mineral-resource potential for phosphate, because the host strata have been eroded; and no resource potential for oil and gas.

1503 Geothermal Exploration And Exploration Technology

12790 **(LA-UR—88-4256) DC resistivity at the Ahuachapan geothermal field, El Salvador.** Fink, J.B.; de la Fuente D., M.; Rodriquez, C.; Cash, D.J.; Gerety, M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-890114—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005479/JAW.

From 14. workshop on geothermal reservoir engineering; Stanford, CA, USA (24 Jan 1989).

Deep dc resistivity surveying has been performed at the Ahuachapan Geothermal Field in western El Salvador. The field lies on the north base if the volcanic range that runs the length of the country and is the site of a significant active geothermal powerplant. The technical purpose of the surveying was to assess the geophysical properties of the geothermal regime around the existing field. The survey was carried out as a colinear dipole-dipole survey using dipole spacings of 500m and 1000m, and dipole separations of up to fourteen dipole lengths. Results included (1) the observation that the geothermal reservoir was not readily detectable due to surface lithologic changes and extensive cultural effects, (2) the hydrothermally altered areas are readily recognized by their low resistivities, (3) local lithologies appear to be mappable based on their in situ resistivities, (4) the greater field logistical convenience of the shorter 500m dipole spacings is negated by the increase in topographic effects, and (5) if appropriate dipole separations are used, there is no need to run surveys of both 500 and 1000 meter dipole spacings to gather shallow and deep information. 7 figs.

12791 **(LA-UR—88-4257) Results of well logging operations at the Ahuachapan geothermal field, El Salvador.** Dennis, B.; Jermance, R.; Lawton, R.; Quintinilla, A.; Berganza, J. (Los Alamos National Lab., NM (USA)). [1988]. Contract W-7405-ENG-36. 7p. (CONF-890114—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005480/JAW.

From 14. workshop on geothermal reservoir engineering; Stanford, CA, USA (24 Jan 1989).

Well logging operations were performed in eight of the geothermal wells at Ahucachapan. A series of high temperature instruments, including temperature/rabbit, caliper, fluid velocity/temperature/pressure (STP) and fluid sampler were deployed in each well. The caliper tool was used primarily to determine the possible chemical desposit buildup in the casing or liner, and in one well to investigate a suspected break in the casing. STP logs were obtained from six of the eight wells at various flow rates ranging from 30 to 70 kg/s. A static STP log was also run with the wells shut in to provide data to be used in the thermodynamic analysis of several production wells. 23 refs., 1 tab.

1520 Geothermal Data And Theory

12792 **(EPRI-GS—6142) Trace arsenic species and equilibria in geothermal fluids.** Cobble, J.W.; Turner, P.J.; Chen, K.D.; Fyke, D.R. (Electric Power Research Inst., Palo Alto, CA (USA); San Diego State Univ., CA (USA). Dept. of Chemistry). Dec 1988. 119p. Research Reports Center, Box 50490, Palo Alto, PA 94303. Order Number TI89004688/JAW.

A comprehensive theoretical and experimental study of the liquid and steam chemistry of arsenic found in geothermal fluids has been used to model the transport of arsenic in geothermal systems. Two new species were identified and characterized in the course of the research which for the first time makes such modelling possible. The chemical equilibrium model developed can be used to predict the expected arsenic levels at key locations in a plant from knowledge of the brine concentration, hydrogen sulfide levels, and temperature in the resource fluid. 27 refs., 7 figs., 59 tabs.

16 TIDAL AND WAVE POWER

1608 Wave Energy Converters

12793 **(ETSU-WV—1651(pt.1)) Belfast Device. Progress report.** (UKAEA Harwell Lab. Energy Technology Div.; Queen's Univ., Belfast, Northern Ireland (UK)). Mar 1982. 15p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Progress on the Belfast Device following Rendel, Palmer and Tritton's assessment in January 1982 is summarised. Primarily the cost of energy produced has been reduced from 15.8 p/KWh to 7.3p/KWh. This has been achieved by increasing device productivity while reducing capital cost per device and simplifying maintenance. The increased productivity is a result of allowing for viscous and vortex losses which dissipate much of the power at model scale. Foundation, electrical inter-connection and maintenance costs have been significantly reduced by using tunnels in the sea bed to gain access to the base of each device. The exceptionally high "one-off" cost of the turbo-generator sets has been reduced to account for mass production in a specialised construction plant. The improved productivity, in conjunction with an increase in the number of devices within the original array, has doubled the annual output of the station.

17 WIND ENERGY

REFER ALSO TO CITATION(S) 13003

1704 Economics

12794 **(HW—86.610.1) Technical and economical developments of wind power. Research renewable energy. Monograph supply chain for wind power, phase 1.** Foellings, F.J. (Holland Windturbine B.V., Utrecht). Sep 1986. 83p. (In Dutch). Holland Windturbine B.V., P.O. Box 3215, 3502 GE Utrecht, Netherlands.

By order of the Dutch Ministry of Economic Affairs the Consultancy Krekel Van der Woerd Wouterse investigated to what extent renewable energy sources can meet the Dutch energy demand for the year 2050. In the framework of this investigation Holland Windturbine, Consulting Engineers, was ordered to carry out a sector study concerning technical and economical developments of the supply chain of wind power. This report presents the results of phase 1: a short discussion of the state of the art in which a description is given of the wind power conversion systems, yields and costs of the systems and aspects of the market for wind power

and wind turbines. Phase 2 is a separate report in which a prognosis is formulated for the future. 23 figs., 23 refs., 5 tabs., 4 app.

12795 **(HW—86.610.2) Technical and economical developments of wind power. Research renewable energy. Monograph supply chain for wind power, phase 2.** (Holland Windturbine B.V., Utrecht). Feb 1987. 115p. (In Dutch). Holland Windturbine B.V., P.O. Box 3215, 3502 GE Utrecht, Netherlands.

By order of the Dutch Ministry of Economic Affairs the Consultancy Krekel Van der Woerd Wouterse investigated to what extent renewable energy sources can meet the Dutch energy demand for the year 2050. In the framework of this investigation Holland Windturbine, Consulting Engineers, was ordered to carry out a sector study concerning technical and economical developments of the supply chain of wind power. This report presents the results of phase 2. It gives summaries of technological developments, cost developments, potential and penetration of wind power, and data on Dutch and foreign suppliers and manufacturers of wind energy conversion systems. Phase 1 is a separate report in which a description is given of wind energy conversion systems, yields and costs of the systems and market aspects concerning wind power and wind turbines. 16 figs., 39 refs., 5 tabs., 6 app.

1705 Environmental Aspects

12796 **(TNO-TPD—523.122/2) Sound- and vibration ranging at the nacelle of the wind turbine WPS 30-3 on a test position.** Tukker, J.C. (Nijverheidsorganisatie TNO, Delft (Netherlands). Technisch Physische Dienst). Jul 1987. 38p. (In Dutch). Technisch Physische Dienst TNO-TH, P.O. Box 155, 2600 AD Delft, Netherlands.

On May 14th, 1987, sound- and vibration measurements were carried out at the nacelle of a WPS 30-3 wind turbine. The nacelle was installed in the assembly hall of Holec-Polenko, Hengelo, Netherlands, and operated idle and without a nacelle-hood. The main purpose of the measurements was to gain insight into the expected sound production on location so that, if necessary, measures could be taken to prevent too much noise. The results of the measurements are presented. In interpreting these results some uncertainties have to be included caused by the idle operation of the wind turbine as well as not using a hood to cover the nacelle. 29 figs., 3 tabs.

1706 Wind Energy Engineering

12797 **(NLR-M-SB—87-070-U) Measured fatigue loads of a vane of a small wind turbine. Section report 5. Design standards for small wind turbines.** Van der Linden, H.H.; Van Lummel, C.W. (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam (Netherlands)). Sep 1987. 34p. (In Dutch). Nationaal Lucht- en Ruimtevaartlaboratorium, P.O. Box 90502, 1006 BM Amsterdam, Netherlands.

During the project 'Design standards for small wind turbines' a measurement program was started for the Berewoud Windvang 80.15 wind turbine. With the 'Spectrapot Data Collector' the bending moment of a vane was recorded. For a number of short periods this has been done in a peak-valley order and for the long-term periods as rainflow matrices. This note describes shortly the carried out measurements and presents an overview of measured loads. 1 fig., 2 tabs., 2 app.

12798 **(NLR-TR—87049-L) Failure load performance of 3-dimensional form joints under variable loads. Section report of phase 2 of the project fatigue load investigation of wind turbine materials.** Bonnee, W.J. (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam (Netherlands)). Mar 1987. 34p. (In Dutch). Nationaal Lucht- en Ruimtevaartlaboratorium, P.O. Box 90502, 1006 BM Amsterdam, Netherlands.

Fatigue load tests were carried out on a number of flange formed rotor blade joints. Variable bending as well as axial fatigue were considered. The tests gave a good indication of the failure load performance under different conditions. 24 figs., 2 refs., 3 tabs.

12799 **(SERI/STR—217-3370) Field investigation of a wake structure downwind of a VAWT [vertical-axis wind turbine] in a wind farm array.** Liu, H.T.; Buck, J.W.; Germain, A.C.; Hinchee, M.E.; Solt, T.S.; LeRoy, G.M.; Srnsky, R.A. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1988. Contract AC02-83CH10093. 80p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000821/JAW.

The effects of upwind turbine wakes on the performance of a FloWind 17-m vertical-axis wind turbine (VAWT) were investigated through a series of field experiments conducted at the FloWind wind farm on Cameron Ridge, Tehachapi, California. From the field measurements, we derived the velocity and power/energy deficits under various turbine on/off configurations. Much information was provided to characterize the structure of VAWT wakes and to assess their effects on the performance of downwind turbines. A method to estimate the energy deficit was developed based on the measured power deficit and the wind speed distributions. This method may be adopted for other turbine types and sites. Recommendations are made for optimizing wind farm design and operations, as well as for wind energy management. 17 refs., 66 figs., 6 tabs.

12800 **(TUD-IW-R—506) The constructional design of the FACT-rotor.** Joosse, P.A. (Technische Hogeschool Delft (Netherlands). Inst. voor Windenergie). Dec 1986. 143p. (In Dutch). Instituut voor Windenergie TU Delft, Kluyverweg 1, 2629 HS Delft, Netherlands.

The constructional design of a wind turbine blade with a tipvane is described. The rotor has an axis of circa 9 m and is equipped with a flexible vane base, a so-called flexbeam. This flexbeam gives the vane a low bending stiffness from the rotor and a low torsional stiffness around the vane axis. The low bending stiffness decreases the dynamic loads on the rotor and the conversion train. The energy yield can be increased considerably by using a tipvane on the end of the blade. Such a vane gives high tip loads. The FACT-rotor (flexible advanced-composite tipvane rotor) is made of advanced materials: carbon reinforced epoxy and aramid reinforced epoxy. 31 figs., 33 refs., 12 tabs., 7 apps.

12801 **(TUD-IW-R—515) The angles of the Kolibrie rotor tipvanes on the rods and on the blades.** Bruining, A. (Technische Hogeschool Delft (Netherlands). Inst. voor Windenergie). Oct 1988. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756343/JAW.

This report contains the data of the adjusted angles of the tipvanes used on the Kolibrie rotor blades and rods. Two measuring methods for the determination of these angles were applied: one method is based on determining the chord vector and the span wise vector of the tipvane. The other method is based on the angles of the mounting parts of the tipvanes. The theoretical background of the different angles systems, used to define the attitude of the tipvane in the 3-dimensional space and the measurement procedure are not included in this report, but is explained in report TUD-IW-R-510 (1987). Due to the unreliability of the position of the chord vector and the span wise vector the results from this first method were not used for further calculations. All further calculations were carried out with the data from the second method, based on the angles of the mounting parts of the tipvanes. 3 figs., 3 refs., 6 tabs.

20 ELECTRIC POWER ENGINEERING

REFER ALSO TO CITATION(S) 13018

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 12535, 12832, 13317, 13499, 13500

12802 **(DOE/PC/79866—T3) Proof-of-concept testing of the HLC technology: Quarterly report.** (Process Technology, Inc., Homer City, PA (USA)). 21 Dec 1988. Contract AC22-87PC79866. 10p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004996/JAW.

Progress on the Heavy Liquid Cyclone project is presented. The building to house the HLC process was erected and the equipment installation began. Most of the earthwork for the outside tanks and facilities was also completed. Items conducted under Task Series 300, Procurement and Fabrication, included: issuing the Installation Manual, finalizing and issuing the report evaluating the HLC cyclone testwork conducted at PTI during the summer, finalizing, ordering and receiving safety equipment for the project, and issuing two drafts of the Operations Manual and receiving critiques from the DOE, EPRI and DuPont. In Task Series 500, Project Plan, the programming for the control software and the database management system was completed. 200 tons of Illinois No. 6 coal was collected from Arch Mineral's Captain Mine clean coal loadout. The schedule for the remaining segment of this project remains largely as put forth in the Operations Manual. Installation will be completed in December. Final commissioning of the process with methylene chloride will occur during the first two weeks in January. The test program with the Illinois No. 6 coal should be well underway the second half of January. Current plans include testing to be complete by the end of April.

12803 **(ENEA-RT-PEC—87-3) Early detection of plant malfunctions: error auto-correlation.** Liburdi, R.; Bruschi, R.; Pallottelli, R. (ENEA, Rome (Italy)). Apr 1988. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755375/JAW.

Plant (power, industrial) malfunctions are detected by the analysis of an error signal between plant variables and corrisponding variables supplied by a real-time numerical model. In the early detection of malfunctions, the existance of an error is ascertained as soon as possible (theorically, upon birth). In the case of "evolving errors", the condition exists in which the error signal is hidden within a noise signal (small SNR). The use of an auto-correlation function is suggested to differentiate an error signal from noise, thereby obtaining early-detection.

12804 **(EPRI-CS—6049) Proceedings: 1987 conference on control systems for fossil fuel power plants.** Diaz-Tous, I.A.; Lansing, N.F. (eds.). (Electric Power Research Inst., Palo Alto, CA (USA); Encor-America, Inc., Los Altos, CA). Dec 1988. 530p. (CONF-8702166—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004829/JAW.

From Conference on control systems for fossil fuel power plants; Atlanta, GA, USA (24 Feb 1987).

These proceedings contain the text of the formal presentations as well as summaries of the working group sessions on selected topics relevant to fossil plant controls. the formal presentations were organized under the following general session titles: control system design and logic; I and C design and human factors; controls to facilitate plant cycling; controls to enhance efficiency; and controls for life extension. Individual projects are processed separately for the data bases.

12805 **(EPRI-CS—6051-Vol.1) Fossil Plant Startup Advisor: Volume 1, Analytic startup evaluation technique: Final report.** Dixon, R.R.; Smoak, R.A.; Kraje, N.B. (Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA)). Dec 1988. 163p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004854/JAW.

The concept of an analytical cost function to optimize drum boiler startup procedures is developed and an example is presented. Terms in the cost function include cyclic life expenditure of boiler and turbine components, fuel costs, load errors, maintenance costs, and auxiliary power costs. In addition, other factors such as water chemistry and acid deposition are discussed. The example shows a comparison of a variable pressure startup versus a constant pressure startup using the Commonwealth Edison Collins unit as the test case. Some sensitivity tests are also presented that show the cost impact of the two procedures when starting from different initial temperatures. A proposed application of the cost function concept as a startup advisor is described. The startup advisor can be used off-line or on-line. When used on-line, it can be used in either a monitoring mode or a predictive mode. A demonstration system is described based on a dynamic model of the Collins unit modified to include a turbine bypass system as well as a superheater bypass system. The system runs on an IBM PC or compatible and is operated manually using the keyboard. The purpose of the demonstration system was to show the significance of different startup configurations and operating procedures at several utility locations. 28 figs., 4 tabs.

12806 **(EPRI-CS—6051-Vol.2) Fossil plant startup advisor: Volume 2, User's manual for a startup model: Final report.** Dixon, R.R.; Kraje, N.B. (Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA)). Dec 1988. 53p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004855/JAW.

These instructions describe how to use the dynamic model of a fossil power plant on the diskette at the back of this document. The model runs on an IBM PC, XT or AT. It was developed as part of an EPRI study on fossil startup problems; RP1184-4. The purpose of the model was to provide a tool to demonstrate problems encountered during startups and potential solutions proposed by various industry experts. Consequently, the accuracy and fidelity of the model was not critical, but rather the ability to operate in various startup configurations was more important. An MMS model of the cycling unit at COLLINS STATION of Commonwealth Edison served as the basis for the model. Some simplifications were introduced to allow it to run on the PC faster than real-time. The most significant of these is the steam property curves. The saturation properties used are reasonable over the entire operating range, but the superheated steam properties are highly inaccurate at low pressures and low temperatures. This limitation does not, however, diminish the value of the model in demonstrating startup problems or in evaluating the relative merits of one solution over another. On the positive side, the model has both a superheater bypass system and a turbine bypass system. Either bypass can be used separately, or they can be used together (something that appears desirable but no utility has been wealthy enough to try yet). In addition, it provides an excellent tool for understanding the operation of a drum type boiler and both superheater and turbine bypass systems. 14 figs.

12807 **(EPRI-CS—6092) Compact Analyzer for fossil plant simulators: Final report.** Khadem, M.; Ipakchi, A. (Electric Power Research Inst., Palo Alto, CA (USA); Systems Control, Inc., Palo Alto, CA (USA)). Dec 1988. 83p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004724/JAW.

This report describes the results of EPRI sponsored project RP1184-12, for the development of an MMS color-graphics analyzer and specifications for fossil-fuel power plant simulators. The system is called Compact Analyzer and was originally designed and developed under EPRI RP2395-2 for nuclear power plant applications. Compact Analyzer is a CRT-based, non-replica simulator with features for both engineering and training applications. This report provides guidelines for the development of power plant simulator specifications, and describes the design of the EPRI Compact Analyzer system, as well as its application as a simulator to fossil-fuel power plants. In this demonstration a full plant model, including the control system, is interfaced with interactive user graphic displays built on an IBM PC. A hierarchical set of displays represent the plant in an increasing level of detail. Displays, in addition to the process schematic diagrams and trend plots, include a representation of control panels with push-button displays for operator control functions. The simulations are controlled through a combination of these displays and a standard keyboard. 13 refs., 12 figs., 1 tab.

12808 **(EPRI-CS—6117-CCM) AFBVAL user's guide: Integrated financial and engineering evaluation of AFBC power plants.** Johnson, M.S.; Roughgarden, J.D. (Electric Power Research Inst., Palo Alto, CA (USA); Decision Focus, Inc., Los Altos, CA (USA)). Dec 1988. 161p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89007192/JAW.

This report describes and illustrates the use of a computer code called AFBVAL developed to assist engineers and planners in

performing integrated engineering-economic evaluations of atmospheric fluidized-bed combustion (AFBC) power plants. AFBVAL is useful for AFBC scoping studies, bid evaluations, and design refinement efforts. AFBVAL computes costs or revenue requirements using a method that is consistent with, but more general than, the approach used in EPRI's Technical Assessment Guide (TAG) and accompanying document on economic premises. The components of revenue requirements are fuel costs, consumable costs (e.g., for sorbent, water, and disposal of solid waste), operating and maintenance (O&M) costs for labor and materials, and carrying charges. Utility system benefits calculated include available generating capacity and electricity generated. Costs and benefits depend not only on economic factors but also on a unit's technical characteristics and fuel and sorbent properties. AFBVAL calculates the unit boiler efficiency; the annual consumption rates for coal, sorbent, water, and other consumables; the annual energy production; and the resulting costs and benefits.

12809 **(EPRI-CS—6117-CCM-Suppl.) AFBVAL user's guide: Integrated financial and engineering evaluation of AFBC power plants: AFBVAL quick start: Supplement.** Johnson, M.S.; Weingart, J.M. (Electric Power Research Inst., Palo Alto, CA (USA); Decision Focus, Inc., Los Altos, CA (USA); Weingart (Jerome) and Associates, Berkeley, CA (USA)). Dec 1988. 37p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004690/JAW.

This report is a user's guide to EPRI's computer code AFBVAL. AFBVAL was developed to assist engineers and planners in performing integrated engineering-economic of atmospheric fluidized-bed combustion (AFBC) power plants. AFBVAL operates on IBM (or fully compatible) microcomputers. The code is menu-driven and incorporates extensive on-line help facilities. (JL)

12810 (EPRI-EL—5807-SR, pp 5.1.1-5.1.7) **The variation of PD-strength for oil-paper insulation with temperature, moisture and loading time.** Carrander, K. Jun 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88011930/JAW. (CONF-871290—).

From Transformer overload and bubble evolution; Palo Alto, CA, USA (8 Dec 1987).

To get a better understanding of the loadability of power transformers at high (150--180{degree}C) hot-spot temperatures tests have been performed on a model. The test sample should simulate the winding insulation and the cleats-and-leads in a power transformer. The tests reported below describe the PD inception voltage as a function of temperature and moisture in oil-impregnated paper at different loading times. 9 figs.

12811 **(EPRI-EL—6145) Computer-aided relay protection coordination: Final report.** Venkata, S.S.; Damborg, M.J.; Jampala, A.K.; Ramaswami, R. (Electric Power Research Inst., Palo Alto, CA (USA); Washington Univ., Seattle (USA). Dept. of Electrical Engineering). Dec 1988. 273p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005539/JAW.

This is the final report on RP2444-2 which provides power system protection engineers with interactive tools for coordination of overcurrent and distance relays. The initial efforts of this project was under RP1764-6 and resulted in the EPRI report EL-3337 and in the first version of a set of computer programs to accomplish the coordination task. This report completes the documentation of that work. Two final versions of the computer codes have been developed and are distributed by Electric Power Software Center, Dallas, Texas, one for IBM mainframes and one for PC's. This report documents all the enhancements of the code beyond the results reported in EL-3337. These enhancements include further development of the database, a more efficient approach to the topological analysis and more efficient algorithms for the coordination of overcurrent and distance relays. An important feature of the code is that these modules are all integrated with a relational database management system (DBMS). The report also contains a discussion of the four test systems used in the code development and validation. Complete results are given for the largest test system, TS 4, a 38 bus, 61 line system from the Puget Sound Power and Light Co. (PSPL). This CAE tool has proven to be very useful in engineering practice. PSPL uses it on a regular basis for their coordination needs and it has proven to give results that are at least as good, and in many respects superior to, those achieved "manually". Of course, it does so with a great savings in engineering effort. Finally, two advanced concepts, namely, subsystem coordination and adaptive transmission protection, are also introduced and described. 52 refs., 56 figs., 27 tabs.

12812 **(EPRI-GS—6160) Evaluation of a Texaco gasification{endash}combined-cycle plant with Kraftwerk Union gas turbines: Final report.** Jacob, J.T.; Chu, L.A. (Electric Power Research Inst., Palo Alto, CA (USA); Fluor Daniel, Inc., Irvine, CA (USA)). Dec 1988. 202p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005224/JAW.

The modular nature of gasification-combined-cycle (GCC) plants is known to facilitate capacity addition in increments (phased construction) that may match more closely with the anticipated growth in electrical load. Because the gas turbines are the primary building blocks of a phased GCC plant, utility planners are investigating in more detail prospective gas turbines of current and advanced designs developed by several manufacturers. This report summarizes the results of the evaluation of a GCC power plant based on the Kraftwerk Union Model V84.2 gas turbines of the current design now offered for the US market. The design of the Model V84.2 machine, a scaled-down version of Kraftwerk Union's 50 Hz Model V94 machine, incorporates features suitable for burning gases, such as coal-derived synthesis gas. 14 figs., 42 tabs.

12813 **(EPRI-GS—6161) Devon station repowering study: Phase 2, Conceptual design of a coal gasification facility: Final report.** Rorstrom, E.G.; Athas, J.G.; Wagner, G.A.; Cooperberg, D.; Bender, D.J.; Willson, E.J. Jr. (Electric Power Research Inst., Palo Alto, CA (USA); Northeast Utilities Service Co., Berlin, CT (USA); Lummus Crest, Inc., Bloomfield, NJ (USA); United Engineers and Constructors, Valley Forge, PA (USA)). Dec 1988. 122p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005741/JAW.

The 1985 conceptual design and economic analysis of a coal gasification facility producing medium-Btu fuel gas from a Pittsburgh bituminous coal is described in this report. The gasification facility is sited at Connecticut Light and Power Company's Devon Generating Station, Milford, Connecticut. The report was prepared by Lummus Crest, Inc., United Engineers and Constructors, and Northeast Utilities Service Company. Northeast Utilities Service Company and the Electric Power Research Institute co-sponsored the study. The facility design incorporates the proprietary Shell Coal Gasification Process. This process uses a pressurized, high temperature, entrained flow gasification reactor to perform the initial conversion of coal to gas. Dry pulverized coal, oxygen, and a small quantity of steam is fed into the process to produce a medium-Btu gas with a higher heating value of 301.0 Btu/SCF. The plant consumes 5688 tons of coal per day to produce 5083 MM Btu/hr of medium-Btu gas. The synthetic gas is supplied to a combined cycle plant adjacent to the proposed facility. Minimal integration of the gasification and combined cycle systems is included in the plant design. A description of the site and plant facilities, including overall material and energy balances, block flow diagrams, and site arrangement drawings, are presented. A description of the major systems, including an equipment summary, are also provided. An overall capital cost estimate and project execution schedule were prepared. An engineering and economic analysis of the impact of adding the coal gasification facility to the repowering project is presented. This analysis, prepared by Northeast Utilities Service Company, compares the gasified coal combined cycle plant with two options, a pulverized coal steam plant and the repowered plant without the gasification facility. 13 figs., 23 tabs.

12814 **Prospects for mini cogeneration systems.** Linden, C. (Micro Cogen Systems, Inc., 16845 Von Karman Ave., Irvine, CA (US));. pp v of Energy technology XIV. Rockville, MD; Government Institutes Inc. (1987). (CONF-870416—).

From 14. annual energy technology conference and exposition; Washington, DC, USA (14 Apr 1987).

The prospects for mini cogeneration systems are discussed. Mini cogenerators stand out far above conventional power producing facilities with regard to efficient use of very finite and diminishing resources. The reason that micro cogeneration has such high prospects is the growing weight of public opinion. According to the N.R.C. via the Washington Post, there is a 45% chance of a nuclear reactor core melt down within the next 20 years in the U.S. The Department of Energy's, Sandia Laboratories, has stated that the financial impact of a catastrophe of this magnitude, involving a moderate size generating station, would be upwards of 300 billion dollars (adjusted for 1987 dollars). The public is finding these statistics unacceptable. It is also becoming public opinion that 'waste', especially in the form of non-renewable resources, must come to an end. The public is becoming increasingly unwilling to watch the environment deteriorate, and species of wild life become extinct almost daily. In short, the weight of public opinion in a free society will be seen in the future as having the greatest impact in determining the tremendous prospects that now lay ahead for power generation realities like packaged cogeneration systems.

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REFER ALSO TO CITATION(S) 12533, 12534, 12535, 12540, 12541, 12802, 13588

12815 **(PB—89-123145/XAB) Preliminary evaluation of the feasibility and economics of acid-deposition precursor control technologies for Maryland electric utilities. Appendix A: discussion of sulfur dioxide and nitrogen oxides emission control technologies. Final report.** McGeehin, M.; McManus, C.; Petrimoulx, H. (Environmental Resources Management, Inc., Annapolis, MD (USA)). Jul 1988. 257p. NTIS, PC A12/MF A01.

This report describes acid-deposition precursor control technologies and evaluates their application to Maryland's coal-fired power plants and the costs associated with these control technologies. Several control technologies could potentially be applicable to Maryland coal-fired power plants. The most widely applicable technologies were found to be coal switching and flue-gas desulfurization for sulfur dioxide emission control, and low NOx burners for nitrogen oxide emission control. However, the level of emission reduction required has not been established, and combinations of control technologies may also be feasible. Estimating the cost of constructing and installing a control technology at a specific site requires a substantial amount of information. Further screening of control alternatives would be necessary to perform these estimates.

12816 **(PB—89-126569/XAB) Advanced Utility Simulation Model, Energy, and Employment Impacts Module (Version 1.0). Final report, September 1982-August 1983.** Hannon, B.; Jackson, R.; Kennedy, D. (Illinois Univ., Urbana (USA). Coll. of Engineering). Oct 1988. 29p. NTIS, PC A03/MF A01.

See also PB—88-204276, and PB—89-126577.

This report is one of an 11-volume series that describes the initial development of the Advanced Utility Simulation Model (AUSM), one of four stationary source emission and control cost-forecasting models developed in 1984 for the National Acid Precipitation Assessment Program (NAPAP). The AUSM model projects air-pollution emissions (SO_2, NOx, and particulate matter), costs of electric generation, electric rate schedules, costs of emissions control, fuel consumption by type, electric-generating technology construction, and generating technology utilizations for existing and new electric generating units by state. The initial versions of AUSM (Version 1.0) was delivered between November 1984 and August 1985. Further development of the AUSM model between 1985 and 1988 has resulted in the development of Versions 2.0 and 3.0. Reports describing Revisions 2.0 and 3.0 are also part of this series.

12817 **(PB—89-126577/XAB) Advanced Utility Simulation Model, User's Guide (Version 3.0). Report for October-December 1987.** Capone, R.L.; May, E.H.; Peterson, C.J. (Science Applications International Corp., McLean, VA (USA)). Oct 1988. 46p. NTIS, PC A03/MF A01.

See also PB—89-126569.

This report describes the procedures for operation of the entire integrated Advanced Utility Simulation Model (AUSM), one of four stationary source emissions and control cost-forecasting models developed in 1984 for the National Acid Precipitation Assessment Program (NAPAP). The AUSM projects air emissions of SO_2, NOx, and particulates from electric utilities; forecasts changes in emissions resulting from reduction initiatives; and assesses the resulting financial and economic impacts of these initiatives on utilities and consumers. Model results, derived from a 1980 baseline, are generated by state for each year from 1980 to 2009. The AUSM (Version 3.0) is available for remote terminal access and operation at EPA's National Computer Center (NCC). A transcription of the AUSM is also available on magnetic tape.

12818 **(PB—89-127484/XAB) Effects of sorbent injection for sulfur dioxide removal on particulate control systems for coal-fired boilers. Final report, October 1984-October 1987.** Gooch, J.P.; DuBard, J.L.; Faulkner, M.G.; Marchant, G.H.; Dahlin, R.S. (Southern Research Inst., Birmingham, AL (USA). Environmental Sciences Dept.). Nov 1988. 131p. (SRI-ENV—88-620-5676). NTIS, PC A07/MF A01.

This report describes studies undertaken to quantify the effects of dry SO_2 sorbent injection on electrostatic precipitator (ESP) operation with a coal-burning utility boiler. The specific operation of interest was EPA's limestone injection, multistage burners (LIMB) process. The combination of spent sorbent and fly ash has a higher resistivity, a higher mass concentration, and a finer particle-size distribution than the ash alone; all of these factors diminish the effectiveness of ESP. Also investigated was chemical conditioning to reduce the resistivity problem, the only one of three concerns stemming from sorbent injection that can be readily mitigated. Other topics studied were: the recycle, disposal, and utilization of waste-ash/sorbent mixtures; the selection and modification of sorbents to improve SO_2 capture in the furnace; and the reactivation of spent sorbent by humidification to achieve supplemental post-furnace capture of SO_2.

12819 **(PB—89-131030/XAB) Analysis of natural gas-based technologies for control of SOx and NOx from existing coal-fired boilers. Topical report, March 1985-December 1986.** Emmel, T.E.; Rimpo, E.T. (Radian Corp., Research Triangle Park, NC (USA)). May 1987. 109p. (RAD—87-205-029-11-05). NTIS, PC A06/MF A01.

This report documents the environmental-benefits analysis of using gas co-firing, gas reburn, and gas reburn combined with sorbent injection to control emissions of SOx and NOx from existing coal-fired utility boilers. The technical and economic feasibility of these gas-based technologies was evaluated on a comparable basis with other pollution-control options. Two analysis techniques were used to quantify the environmental benefits of the gas technologies. A parametric analysis was conducted using model boiler cases to identify the key boiler/fuel parameters that impact the competitiveness of the gas technologies with conventional SOx and NOx controls. An analysis of the top 100 SOx-emitting boiler population was conducted to evaluate the competitiveness of the gas-based technologies for various emission-reduction levels that may be required by acid rain legislation. Economic and environmental benefits of using gas for pollution control were calculated in terms of costs savings, pollution reductions, and gas market.

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REFER ALSO TO CITATION(S) 13077

12820 (EPRI-EL—5807-SR, pp 1.1.1-1.1.26) **Finally, we're here!.** Compton, O.R. Jun 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88011930/JAW. (CONF-871290—).

From Transformer overload and bubble evolution; Palo Alto, CA, USA (8 Dec 1987).

The actual load carrying ability of a transformer vs its name-plate rating has been a subject of controversy since the first transformer was sold. The name-plate rating is basically a fixed design value based on the transformer's performance in a very specific,

fixed environment. The actual load carrying ability is a function of the environment existing in real-time. In any effort to understand and define the load carrying ability of a specific transformer, it is necessary to know the history of the parameters considered in transformer loading. This paper reviews the literature on transformer loading concerns from 1911, when Steinmetz and Lamme wrote their treatise on the basis of insulation limiting temperatures to 1980 when the Electric Power Research Institute (EPRI) work described at this Workshop was begun. The industry, through these years, has gradually moved from a philosophy that aging is a function of the half-life of the paper's tensile strength to one where the demonstrated ability of the transformer to perform its function is the proper criterion. 72 refs., 1 tab.

12821 (EPRI-EL—5807-SR, pp 2.1.1-2.1.11) **McGraw-Edison investigation of the physical and dielectric effects of gas and bubble formation from cellulose insulated transformer hot spot conductors at elevated temperatures.** Heinrichs, F.W. Jun 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88011930/JAW. (CONF-871290—).

From Transformer overload and bubble evolution; Palo Alto, CA, USA (8 Dec 1987).

This paper reviews the experimental programs conducted by the McGraw-Edison Power Systems Division, Cooper Industries, Inc., in which observation of gas and bubble evolution and their impact on the dielectric strength of heated conductor insulation was first reported. The review relates the experimental data to operating risk and discusses some of the issues addressed in this Workshop. 6 refs., 7 figs., 1 tab.

12822 (EPRI-EL—5807-SR, pp 2.2.1-2.2.4) **General Electric Transformer Life Characteristics program (EPRI-RP-1289-1).** McNutt, W.J. Jun 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88011930/JAW. (CONF-871290—).

From Transformer overload and bubble evolution; Palo Alto, CA, USA (8 Dec 1987).

The work performed by General Electric on Transformer Life Characteristics in 1977 to 1982 is documented in EPRI Report EL-2443 and in two IEEE papers. This program was directed toward evaluation of both short term and long term effects of heavy loads on transformer life, but did not specifically anticipate that formation of free gas bubbles would play a significant role in determining the safe degree of loading beyond nameplate rating. There were two parts to the program. In the first, the dielectric strength of representative transformer winding and lead structures was measured over a wide range of temperatures, with the heating produced by current in the conductors. In the second, functional life tests were performed on transformer winding models. The evidence of bubble formation which was seen during each of the sets of investigations will be summarized in this paper. 2 refs., 3 figs.

12823 (EPRI-EL—5807-SR, pp 2.3.1-2.3.18) **Gas bubble studies and impulse tests on distribution transformers during loading above nameplate rating.** Kaufmann, G.H.; McMillen, C.J. Jun 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88011930/JAW. (CONF-871290—).

From Transformer overload and bubble evolution; Palo Alto, CA, USA (8 Dec 1987).

This paper is based on an investigation supported by the Electric Power Research Institute as part of a larger study into anomalous failures in transformers attributable to lightning surges. The work describes the results of radio noise measurements and visual observation on distribution transformer winding models to gain insight into gas bubble development and behavior during simulated overload conditions and during aging. Full-wave impulse breakdown data on three different distribution transformer designs is presented and discussed. The tests were made on both new and aged transformers during a one hour load at 260 to 285% of rated current. The results are assessed in comparison with breakdown tests under no-load conditions. 11 refs., 8 figs., 3 tabs.

12824 (EPRI-EL—5807-SR, pp 3.1.1-3.1.5) **The initial mathematical model of bubble evolution in transformers.** McNutt, W.J. Jun 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88011930/JAW. (CONF-871290—).

From Transformer overload and bubble evolution; Palo Alto, CA, USA (8 Dec 1987).

The mathematical model examines the concentrations of all gases dissolved in the local oil at the transformer hottest spot conductor and the partial pressures exerted by each gas. The criterion for free gas bubble evolution is that the summation of partial pressures of the dissolved gases (including water vapor) must exceed the static pressure at that point. The static pressure is made up of the head of oil over the conductor, plus the external pressure at the free oil surface. 3 refs., 5 figs.

12825 (EPRI-EL—5807-SR, pp 4.1.1-4.1.8) **Transformer overload characteristics.** Woods, E.E. Jun 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88011930/JAW. (CONF-871290—).

From Transformer overload and bubble evolution; Palo Alto, CA, USA (8 Dec 1987).

Electric Power Research Institute (EPRI) Project RP 1289-3 explores significant parameters that could cause bubble evolution during transformer loading. The project is an attempt to answer the question: Does "real life" operation of a transformer cause harmful bubbling from the insulation system? The project examines conditions under which bubbling could occur in control models and in full size transformers. A thermal model test program was organized to study the parameters which cause bubble formation and also provide information which would predict bubble evolution. A dielectric model test program was designed to measure the dielectric strength reduction of insulation structures exposed to bubble evolution. Both the thermal and dielectric models were designed to correlate with the design of the test transformers. Two single phase 12/16/20 MVA OA/FA/FOA test transformers were designed and built to be representative of power transformers now in service. These transformers were constructed so that the location and source of bubble formation could be identified and recorded. The transformers were equipped with large glass viewports, thermocouples, and lights. The two 20 MVA transformers were manufactured using different types of cellulose insulation (Kraft and thermally upgraded Kraft) to address both older and current transformer designs. The transformers were also fitted with apparatus to alternate the cooling mode and the type of oil preservation system.

12826 (EPRI-EL—5807-SR, pp 5.2.1-5.2.4) **CIGRE survey on maximum safe operating hot spot temperature.** McNutt, W.J. Jun 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88011930/JAW. (CONF-871290—).

From Transformer overload and bubble evolution; Palo Alto, CA, USA (8 Dec 1987).

A survey of Working Group members and other interested parties in the represented countries to determine whether a single safe temperature limit could be set for the hot spot in operating transformers and what were the most important considerations in setting a limit was conducted. There were (15) returns from (10) countries. This paper will briefly summarize the survey consensus and will present a discussion of some experimental data which was provided in the responses. 3 tabs.

12827 (EPRI-EL—5807-SR, pp 6.4.1-6.4.8) **Bubble evolution in transformers: A utility perspective.** Thaden, M.V. Jun 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88011930/JAW. (CONF-871290—).

From Transformer overload and bubble evolution; Palo Alto, CA, USA (8 Dec 1987).

The concern for degradation of dielectric strength that would occur if free gas bubbles formed within the insulation system of a power transformer has caused PEPCO to limit the maximum allowable winding hot spot temperature in the calculations of transformer loading ratings. The winding hot spot temperature generally is the first limit achieved in calculating transformer ratings. This limit, therefore, reduces transformer capacity available for use in

supplying load. Examples of the magnitude of this impact are presented that demonstrate the need for a method to confidently determine the possibility of bubble formation. 1 fig., 4 tabs.

12828 (EPRI-EL—5807-SR, pp 7.1.1-7.1.9) **Summary and conclusions.** McNutt, W.J. Jun 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88011930/JAW. (CONF-871290—).

From Transformer overload and bubble evolution; Palo Alto, CA, USA (8 Dec 1987).

Preliminary remarks addressed the need for application rules to guide loading decisions. The rules must recognize and take into account differences between transformers. The purpose of the Workshop was to review the findings of investigations over the past 7--8 years and to determine whether enough information is now available for utilities to establish safe loading practices.

12829 (EPRI-EL—5807-SR, pp 6.1.1-6.1.6) **Managing overloads: The utility challenge.** Norton, E.T. Jun 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88011930/JAW. (CONF-871290—).

From Transformer overload and bubble evolution; Palo Alto, CA, USA (8 Dec 1987).

The economic realities facing electric utilities today from cogeneration, deregulation, and inordinate pressure from Public Service Commissions dictates that new approaches need to be developed. One effective way to economize is to use the loading capability of equipment on the system. To accomplish this, the utility needs to measure the hottest spot temperature of loaded equipment. The subject of loading transformers beyond nameplate rating has been debated since the end of World War II, with many unknowns addressed in the Transformer Committees. A thread woven through all these discussions has been the absence of a direct reading hotspot detector to measure the temperature of the winding conductor to properly determine the life of the paper or enamel next to it. Currently, a commercially available detector is being used to eliminate the fear of compromising the reliability of power transformers.

12830 **(PB—89-852925/XAB) Electrical power transients. January 1970-August 1985 (Citations from the COMPENDEX data base). Report for January 1970-August 1985.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 133p. NTIS PC N01/MF N01.

This bibliography contains citations concerning electric-power-transient modeling, simulation, and stability-problem analysis. Fast-transient stability programs, coherency based dynamic equivalents, computer-assisted transient-network analyzers, and slip-stabilization studies are among the topics discussed. Security, contingency planning, and strategies pertaining to network stability are included. (This updated bibliography contains 175 citations, none of which are new entries to the previous edition.)

12831 **(PB—89-852933/XAB) Electrical power transients. September 1985-December 1988 (Citations from the COMPENDEX data base). Report for September 1985-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 127p. NTIS PC N01/MF N01.

Supersedes PB—85-866952.

This bibliography contains citations concerning electric-power-transient modeling, simulation, and stability-problem analysis. Fast-transient stability programs, coherency-based dynamic equivalents, computer-assisted transient network analyzers, and slip-stabilization studies are among the topics discussed. Security, contingency planning, and strategies pertaining to network stability are included. Transient stability due to lightning surges are excluded and examined in a separate bibliography. (This updated bibliography contains 231 citations, all of which are new entries to the previous edition.)

12832 **Adaptive transmission relaying concepts for improved performance.** Rockefeller, G.D. (Electric Research and Management, St. Rose, LA (US)); Wagner, C.L. (Electric Research and Management, Export, PA (US)); Linders, J.R. (Consultant Sarasota, FL (US)); Hicks, K.L. Sr. (Stone and Weber Engineering, Boston, MA (US)); Rizy, D.T. (Energy Div., Oak Ridge National Lab., Oak Ridge, TN (US));. *IEEE Transactions on Power Delivery;* 3: No. 4, 1446-1458(Oct 1988).

Concepts for adaptive protective relaying of transmission lines are presented. These include changes in on-line relay settings, relay characteristics or logic in response to power system or environmental changes, or a result of operating experience. Such changes as line-out or generator-out contingencies, which affect fault current distributions and degrade the system's security level, initiate adaptive protection system (APS) responses. Adaptive relaying is shown to be capable of improving relaying reliability and power system security plus achieving better utilization of transmission facilities. Most of the concepts require a hierarchical computer system, involving front-line, parallel processors, a substation host and remote central processors, linked by channels that transmit data or relaying changes prior to or after a disturbance. Maximum value from adaptive relaying will result from integration with existing or planned substation control and data acquisition (SCADA) functions and interfacing with the central energy management system (EMS). Emphasis is placed on use of interim hardware approaches to allow evolutionary development, starting with just local signals and the first level of a hierarchy.

12833 **Ground-based transmission line conductor motion sensor.** Jacobs, M.L.; Milano, U. (to Dept. of the Interior, Washington, DC). US Patent Application 7-234,768. 22 Aug 1988. 25p. NTIS, PC A03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

A ground-based-conductor motion-sensing apparatus is provided for remotely sensing movement of electric-power transmission lines, particularly as would occur during the wind-induced condition known as galloping. The apparatus is comprised of a motion sensor and signal-generating means which are placed underneath a transmission line and will sense changes in the electric field around the line due to excessive line motion. The detector then signals a remote station when a conditioning of galloping is sensed. The apparatus of the present invention is advantageous over the line-mounted sensors of the prior art in that it is easier and less hazardous to install. The system can also be modified so that a signal will only be given when particular conditions, such as specific temperature range, large-amplitude line motion, or excessive duration of the line motion, are occurring.

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REFER ALSO TO CITATION(S) 12921, 12953, 12966, 14068

12834 **(IAEA-TC—610) Proceedings of the first technical committee meeting held in Vienna, Austria, 17-20 November 1987.** (International Atomic Energy Agency, Vienna (Austria). Div. of Nuclear Safety). 1987. 357p. (CONF-8711178—). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW.

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

This was the first Technical Committee meeting organized by the International Atomic Energy Agency on reactivity transient accidents as a response to recommendations made during the Chernobyl Post Accident Review Meeting (25-29 August 1986) and the subsequent Member States Experts meeting to review the IAEA expanded nuclear safety programme. The Technical Committee meeting was attended by 46 representatives from 28 countries and 1 international organization. The objectives of the Technical Committee meeting were: to review the state of knowledge and to assess the remaining safety questions relating to reactivity initiated accidents (RIAs); to share experience and information on RIA assess-

ment and relevant fuel experiments; to formulate conclusions on what the consensus might be on safety aspects of the RIAs; and to provide recommendations for sharing the technical information and for IAEA assistance to Member States. A separate abstract was prepared for each of the 17 presentations of this meeting. Refs, figs and tabs.

12835 **(NUREG/CR—2000-Vol.7-No.4) Licensee Event Report (LER) compilation for month of April 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data; Oak Ridge National Lab., TN (USA)). May 1988. Contract AC05-84OR21400. 126p. (ORNL/NSIC—200-Vol.7-No.4). NTIS, PC A07/MF A01 - GPO - OSTI. Order Number TI88010888/JAW.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one-month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. The LER summaries in this report are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, keyword, and component vendor indexes follow the summaries. Vendors are those identified by the utility when the LER form is initiated; the keywords for the component, system, and general keyword indexes are assigned by the computer using correlation tables from the Sequence Coding and Search System.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 12711, 12713, 12842, 12894, 12897, 12898, 12907, 12922, 12928, 12929, 12930, 12934, 12936, 12938, 12939, 12940, 12958, 12963, 12967, 12969, 13342

12836 **(ASEA-ATOM-UK—88-127) Irradiation induced swelling of nuclear fuel.** Massih, A. (ASEA-ATOM AB, Vaesteraas (Sweden)). 5 Feb 1988. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756629/JAW.

We present a model developed for fuel swelling for the purpose of fuel performance analysis to be implemented in the code STAV-6. More specifically we present in some detail the gaseous swelling model which is physically based and is compatible with our previously developed high temperature fission gas release model. Furthermore, we present and evaluate some experimental data obtained by nondestructive poolside gamma scanning on rods of different density and pore size distribution and character, manufactured by ASEA-ATOM and irradiated in the Oskarshamn 2 reactor.

12837 **(EGG-M—00788) Flooding, AFW penetration, and visual investigations in scaled once through steam generator facilities.** Condie, K.G.; Larson, T.K.; McCreery, G.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 12p. (CONF-880724—27). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005192/JAW.

From 25. American Society of Mechanical Engineers/American Institute of Chemical Engineers/American Nuclear Society national heat transfer conference; Houston, TX, USA (24 Jul 1988).

Two different scaled facilities representing various aspects of once through steam generator hardware have been constructed at the Idaho National Engineering Laboratory. The purpose of these two facilities is to examine the heat transfer, flooding, and multidimensional characteristics of the once through steam generator during auxiliary feedwater injection. A heated single-tube facility with a single tube support plate was built to examine the details of flooding and heat transfer. An unheated, 1/8 sector, 625 tube facility containing 3 axially stacked broached hole tube support plate was built to help quantify flooding and the axial, radial, and azimuthal penetration of auxiliary feedwater under gas up-flow conditions. Both facilities operate at atmospheric conditions. Data obtained to date indicate that flooding in the multitube facility is described by a flooding line with a higher intercept but the same slopes as that which characterizes the flooding in the single-tube facility. Penetration experiments indicate that axial, radial, and azimuthal spreading is a strong function of auxiliary feedwater flowrate and a weak function of gas upflow for air flows up to conditions near the flooding line. 13 refs., 13 figs., 1 tab.

12838 **(EGG-M—88326) Results and analysis of the INEL once through steam generator air-water and steam-water experiments.** Larson, T.K.; Condie, K.G.; McCreery, G.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 27p. (CONF-8810155—31). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005138/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

Experiments have been conducted in steam/air facilities that model B&W Once Through Steam Generator (OTSG) heat transfer and fluid flow behavior during auxiliary feedwater (AFW) injection. The experiments and analysis described in this paper examine the basic phenomena of AFW radial and axial flow distribution, tube support plate (TSP) flooding, and tube heat transfer. Flow distribution is studied visually and measured in an unheated multi-tube (625 tubes) full scale 1/8 sector of the OTSG that includes three TSP's. Heat transfer is examined in a heated single tube facility with either one or two broached hole support plates and either air or steam upflow. The flow distribution experiments indicate that radial, axial, and azimuthal spreading is a strong function of AFW flow rate and a weaker function of vapor upflow although liquid spreading becomes an increasingly stronger function of vapor upflow as the flooding line is approached. A semi-empirical model of AFW penetration without gas flow is presented. The model is extended to include the influence of gas flow by correlation. The heat transfer experiments indicate that heat transfer is highly dependent on AFW injection rate, and in particular on whether or not the water flows down the tubes as a continuous film or breaks into rivulets. A computer model of heat transfer has been developed, and is described. The data gathered during the experiments and the models developed from this data are currently being incorporated into the RELAP5 computer code. 20 refs., 16 figs.

12839 **(EPRI-NP—6168) Zinc injection to control radiation buildup at BWRs: Plant demonstrations.** (Electric Power Research Inst., Palo Alto, CA (USA); General Electric Co., San Jose, CA (USA). Nuclear Energy Div.). Jan 1989. 88p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005540/JAW.

Over the past several years, operating plant correlations and laboratory experiments have shown that the presence of trace quantities of soluble zinc in the Boiling Water Reactor (BWR) will suppress Co-60 buildup on recirculation system piping. Project RP2758-1 has been initiated to monitor and report on the implementation of this technology at the first plants to implement zinc injection. This first report documents the first cycle of zinc injection at Hope Creek; a new reactor, and presents the results of an initial mid-cycle gamma scan and an end-of-cycle gamma scan, which both show average dose rates a factor of approximately 2 lower than would have been expected without zinc present. It also presents the results of a successful demonstration test and subsequent permanent implementation at Millstone Pt. 1, a mature reactor. Data from these two reactors suggest possible unanticipated benefits from zinc injection in the areas of reactor water soluble Co-60 reduction and lower curies of Co-60 in the waste shipments. An unexpected release of soluble Zn-65 from the fuel deposits to the reactor water during the refueling outage is discussed. 9 refs., 62 figs., 6 tabs.

12840 **(IAEA-R—3424-F) Nuclear power risk criteria for Mexico. Final report for the period 1 May 1983 - 30 September 1987.** Meade, D. (Comision Nacional de Seguridad Nuclear y Salvaguardias, Mexico City). (International Atomic Energy Agency, Vienna (Austria)). Aug 1988. 45p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705328/JAW.

The preliminary sequence of events for three types of LOCAs (low, medium and large) and seven transients, particularly

turbine trip, loss of offsite power were developed. All of the systems involved in the sequence were examined and analysed in detail and a success criterion was defined for each system in accordance with the initiating events. The difference of transient with and without SCRAM was discussed and a special sequence for the last case (ATWS) was developed. The quantification of the sequence was performed using some results from the PSA (level 1) for Laguna Verde Nuclear Power Plant (LVNPP) and the most significant sequences were shown. 16 refs, 7 figs, 7 tabs.

12841 **(NUREG/CR—5195) Fatigue strength of ASME SA 106-B welded steel pipes in 288{degree}C air environments.** Terrell, J.B. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Materials Engineering Associates, Inc., Lanham, MD (USA)). Dec 1988. 49p. NTIS, PC A03/MF A01 - GPO - OSTI. Order Number TI89005362/JAW.

Fatigue life tests were performed on 102-mm (4-in.) girth butt welded SA 106-B steel pipes in 288{degree}C air under axial loading with a load ratio (R) of -1.00. The fatigue strength at 10^7 cycles was determined to have an extrapolated value of 66.9 MPa (9.7 ksi), and the fatigue strength reduction factor (K/sub f/) was determined to be 3.47. Crack initiation usually occurred at the notch located at the internal weld fusion line on the inside diameter of each pipe, at the point of weld bead overlay. In all cases, the fatigue crack progressed on a plane normal to the pipe axis. The presence and relative number of secondary initiation sites, observed at internal weld fusion line locations around the pipe circumference, appeared to be a function of applied stress amplitude. ASME Section III analysis of the data, using the procedures given in NB-3228.5 and NB-3653.5, resulted in alternating stress (S/sub alt/) values which were conservative when compared to the ASME Section III mean data line for carbon steels. The results of this study successfully provide baseline data for comparison with proposed fatigue life tests of girth butt welded pipes containing 288{degree}C PWR environments at 13.8 MPa, under axial loading at a cyclic frequency of 0.017 Hz. 25 refs., 18 figs., 5 tabs.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 12661, 12708, 12838, 12841, 12868, 12884, 12885, 12888, 12890, 12894, 12897, 12907, 12908, 12917, 12922, 12924, 12925, 12926, 12927, 12929, 12931, 12933, 12934, 12939, 12940, 12941, 12942, 12943, 12944, 12957, 12958, 12961, 12964, 12967, 12969, 13108, 13342

12842 **(CEA-N—2557) Contribution to the validation of the Apollo code library for thermal neutron reactors.** Tellier, H.; Van der Gucht, C.; Vanuxeem, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Recherches Metallurgiques Appliquees). Mar 1988. 46p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754941/JAW.

The neutron nuclear data which are needed by reactor physicists to perform core calculation are brought together in the evaluated files. The files are processed to provide multigroup cross sections. The accuracy of the core calculations depends on the initial data which are sometimes not accurate enough. Therefore the reactor physicists carry out integral experiments. We show in this paper, how the use of these integral experiments and the application of the tendency research method can improve the accuracy of the neutron data. This technique was applied to the validation of the Apollo code library. For this purpose 60 buckling measurements (34 for uranium fuel multiplying media and 26 for plutonium fuel multiplying media) and 42 spent fuel analysis were used. Small modifications of the initial data are proposed. The final values are compared which recent recommended values of microscopic data and the agreement is good.

12843 **(CNIC—00089) Research design and improvement of high temperature high pressure solenoid valve.** Luo Yongtang. (Research Inst. of Nuclear Power Operation, Wuhan, HB (China)). (China Nuclear Information Centre, Beijing, BJ). Dec 1987. 7p. (In Chinese). (RINPO—0003). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705043/JAW.

A process for development of the pilot type high temperature high pressure solenoid valve used in a PWR power plant is described. The whole development process might be divided into two phases: research design and improvement. In the former phase the questions had chiefly been approached in the following several aspects: the principle construction design, the determination of values for the constructionally key elements, the valve seal design and the solenoid actuator design, and made such valve's successful design in the main. In the latter phase an improvement had been made upon such valve against the problems during the testing use of the valve for a period of time, i.e. the unsatisfactory leak tightness, and achieved satisfactory results. The consummate success in this development not only has met the needs of the engineering project, but also made us obtain a valuable experience useful to design the similar valves.

12844 **(CONF-8810155—34) Eddy-current inspection for steam generator tubing program: Annual progress report for period ending December 31, 1988.** Dodd, C.V.; Deeds, W.E.; Pate, J.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005340/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

Reflection probes have demonstrated an improved capability to detect and size defects in degraded steam generators. We have been optimizing the reflection probes and the instrument operating parameters for steam generator inspections. We have developed programs that accurately calculate the changes in the eddy-current sheets, tube supports, copper deposits, magnetite deposits, denting, and defects. Other programs compute the accuracy and sensitivity of eddy-current measurements of defects in the presence of these property variations. These programs have been run to optimize reflection, pancake and circumferential coils. A comparison between the optimum of each type showed that the reflection coils are best, the pancake coils next and the circumferential coils are worst. We have designed both single reflection coil probes and an array of 16 reflection coils. We have also studied the accuracy of the defect theory for reflection, pancake and circumferential coils and experimentally verified the theory. The newest inversion technique shows good potential for a direct and accurate determination of defect size and depth. 8 figs.

12845 **(ENEA-RT-TERM—87-4) Experimental tests on PWR generator dynamics at FREON 12 water simulated conditions.** Fabrizi, F.; Rinaldi, L.; Sala, M.; Urbani, G.; Vigevano, L. (ENEA, Rome (Italy)). Mar 1988. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755377/JAW.

This paper reports some experimental results on the dynamics of natural circulation, U-tube Steam Generators (SGs). The tests have been carried out on the mock-up (FREGENE test section) of a prototypical SG, set up in the CFA Freon - Water Test Facility at ENEA - CRE Casaccia Laboratories, Rome. The scaling criteria derived from a reference prototypical SG, and used to design the outstanding features of the FREGENE test section, are described. This test section, i.e. a SG mock-up at Freon 12 - water simulated conditions, contains a 15 U-tube (INCONEL 600) bundle with 27 mm pitch, 19.05 mm outer diameter and 1.15 mm tube wall thickness; the 6.22 m average length of tubes corresponds nearly to a 0.4 reduction factor with respect to the prototype. Pre-test predictions of the SG one-dimensional thermohydraulic computer programs (ANTARES and ALBERTINE), developed by ANSALDO, have allowed the verification of the scaling procedures; a comparison of such predictions with the steady-state experimental data confirms the validity of the mock-up design. The present experimental results cover: (a) steady-state tests; (b) transients with step or ramp variations of the load; (c) upset transients; (d) instability tests. The results of transient tests exhibit the typical trends occurring in an actual SG and offer a good basis for validating SG computer programs. The instability tests show threshold values very far from the nominal load (200kW).

12846 (FRNC-TH—3347) Stresses, fatigue and fracture analysis in the tube sheets. Billon, F. (Paris-6 Univ., 75 (France); Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France)). May 1986. 363p. (In French). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88754951/JAW.

The purpose of the present work is to study the behaviour of the nuclear PWR steam generator tube sheet. But the methods developed in this field can easily be generalized in order to study tube sheets from any other type of heat exchangers. The aim of the stress analysis of these sheets is to verify their correct design, to quantify the risk of fatigue damage in the areas submitted to a high stress concentration and through the fracture mechanic, to make sure there is no risk of fast fracture resulting from initiated or pre-existing defects. This analysis necessarily relates to the calculation of stresses in all parts of the multidrilled area, mainly around the holes where they are concentrated. However the tube sheets are so complexe structures that their direct modelization cannot be envisaged within the context of the finite element method. We then must refer to the concept of equivalent medium in order to calculate the nominal stresses. Then using the stresses multiple fonctions appropriate to the net geometry, we can calculate the actual stresses concentrated around the holes. The method depends on the behaviour of the elementary volume which represents the behaviour of the multidrilled medium. This approach must allow to correctly take account of the "thermal skin effect", which is a phenomenon particular to the tube sheets with thermal loads. It must as well be generalized in order to analyse the irregular ligaments which affect the periodical stresses distribution and locally overconcentrate them.

12847 (IAEA-R—3423-F) ANGRA-1 probabilistic safety study. Final report for the period 30 April 1983 - 14 December 1987. Arrieta, L. (Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ). (International Atomic Energy Agency, Vienna (Austria)). Aug 1988. 83p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705327/JAW.

For the establishment of interim safety goals a methodology for calculating consequences and risks associated with the Angra-1 operation was developed. The most important contributors to the core melt frequency are two occurrences. The first is loss of main feedwater whose contributions correspond to 66.4% of the total core melt frequency calculated for two years of data collection. The second major contributor is a loss of offsite power case which contributes 33.2% of the total. The development of emergency procedures for addressing severe accidents consist of proposals to help in delaying and minimizing the release of radioactive products to the environment. The Angra-1 PSS calculated the less reliable lines as being the hot legs suction lines. The interface LOCAs contribution to the consequences can be reduced by the improvement of the reliability of the hot legs suction lines through the installation of extra isolation valves. Refs, figs and tabs.

12848 (IAEA-R—4032-F) Importance of independent and dependent human error to system reliability and plant safety. Final report for the period 1 December 1984 - 31 March 1987. Dach, K. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). (International Atomic Energy Agency, Vienna (Austria)). Aug 1988. 94p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705329/JAW.

Uncertainty analysis of the quantification of the unavailability for the emergency core cooling system was made. The reliability analysis of the low pressure injection system (LPIS) of the ECCS of WWER-440 reactor was also performed. Results of reliability analysis proved that LPIS reliability under normal conditions is sufficient and can be increased by two orders of magnitude. This increase in reliability can be achieved by means of simple changes such as securing an opening of the quick-acting fittings at LPIS discharge line. A method for analysis of systems uncertainty with periodic inspected components was elaborated and verified by performing an analysis of the medium size system. Refs, figs and tabs.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 12905, 12909, 12910, 12935, 12945, 12946, 12947, 12948, 12955, 12959, 13111

12849 (JAERI-M—88-138) Verification of in-vessel thermal and hydraulic analysis code 'FLOWNET'. Maruyama, Soh; Sudo, Yukio; Murakami, Tomoyuki; Kiso, Yoshihiro. (Japan Atomic Energy Research Inst., Oarai, Ibaraki. Oarai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jul 1988. 42p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756557/JAW.

This report presents the verification results of in-vessel thermal and hydraulic analysis code, "FLOWNET", for the High Temperature engineering Test Reactor (HTTR). The experimental results by 1 column test facility and in-core structure test section (HENDEL T/sub 2/) were used in course of validation of accuracy of the code and of adequateness of data-base. Verification results showed quite good agreement with the experimental results.

12850 (JAERI-M—88-147) Thermal mixing of coolant flows in a high temperature gas-cooled reactor. Seven-jet mixing experiments in a plenum block. Kunugi, Tomoaki. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 68p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756559/JAW.

This paper describes the experimental results concerned with the characteristics of the thermal mixing in the plenum block of the high temperature gas-cooled reactor. In consequence of the seven-jet mixing experiments using three scale models simulating the planum block, it is found that the characteristics of the thermal mixing in the plenum block can be evaluated by the functions of temperature differences in the horizontal cross-section and ratios of flow rates. Moreover, it is found that the sufficient thermal mixing in the present design of the plenum block can be obtained.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 12867, 12892, 12938, 12949, 12954, 12996, 13095

12851 (INFO—0151) Predicted fission product release from overheated fuel in 850 MWe CANDU reactors. A generic study. Weaver, K.R.; Langman, V.J. (Idea Research, Toronto, Ontario (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Feb 1985. 224p. NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS. Order Number DE88705107/JAW.

A generic study was carried out on the predicted fission product release from overheated fuel in CANDU 850 MWe reactors. The sensitivity of release predictions to increased fuel temperatures and to a change in the release model used in the prediction was studied. Two fuel temperature scenarios were used, with fuel temperatures calculated by the code CHAN-II (MOD4). Based on a limited number of computer runs of the codes CURIES-II and FASTGRASS, a methodology was developed that estimates core-wide release of fission products. The representative species used in the calculations was iodine-131. A standarised form of temperature transient was used and the release was assumed to consist of four components: those due to the free inventory, due to the Zircaloy-UO/sub 2/ interaction, during the period of increasing fuel temperature and during the period of constant or nearly constant high fuel temperature. The results show that CURIES-II predicts greater release of I-131 than does FASTGRASS under both fuel temperature scenarios. Detailed results show the variations in release from the various channel power groups and from the four fuel rings in the bundles. The increase in amount of hydrogen produced and in the heat load rejected to the moderator at the higher fuel temperatures is also documented.

12852 **(INFO—0190-2) Mode shape and natural frequency identification for seismic analysis from background vibration. Phase 2.** Bhan, S.; Wozniak, Z. (Acres International Ltd., Niagara Falls, Ontario (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Oct 1986. 166p. NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS. Order Number DE88705115/JAW.

Background vibration in a CANDU plant can be used to determine the dynamic characteristics of major items of equipment, such as calandria, the fuelling machines and the primary heat transport pumps. These dynamic characteristics can then be used to verify the seismic response of the equipment which, at present, is based on theoretical models only. The feasibility and basic theory of this new approach (which uses accelerations measured at several points on a structure and does not require knowledge of the source of excitation) was established in Phase I of the study. This report is based on Phase II in which the methods of analysis developed in Phase I were improved and verified experimentally. A Fast Fourier Transform (FFT) algorithm was incorporated and an interactive curve fitting technique was developed to obtain the dynamic characteristics in the form of natural frequencies, mode shapes and damping ratios. The method is now available for use at a CANDU plant.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 12654, 12950, 12956, 12968, 13340, 13344

12853 **(CEA-DRNR-R—88-01) Fast neutron reactors department: Activity report 2nd half-year 87.** (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. des Reacteurs a Neutrons Rapides). Sep 1987. 214p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88754938/JAW.

This fast neutron reactors department activity report for the 2nd half-year 87 is divided into 4 parts: - Prominent acts - Technical informations - Action sheet - Meetings DRNR participation.

12854 **(CNIC—00091) New neutron noise technique for fast reactors. Thermalization measurement technique for the neutron noise of fast reactors.** Zhuo Fengguan; Jin Manyi; Yao Shigui; Su Zhuting. (Southwest Inst. of Nuclear Reactor Engineering, SC (China)). (China Nuclear Information Centre, Beijing, BJ). Dec 1987. 16p. (In Chinese). (SINRE—0005). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705045/JAW.

This paper gives a new neutron noise technique for fast reactors, which is known as thermalization measurement technique of the neutron noise. The theoretical formulas of the technique were developed, and a digital delayed coincidence time analyzer consisted of TTL integrated circuits was constructed for the study of this technique. The technique has been tested and applied practically at Df-VI fast zero power reactor. It was shown that the provided technique in this work has a number of significant advantages in comparison with the conventional neutron noise method.

12855 **(CONF-880911—28) Topics in data adjustment theory and applications.** Hwang, R.N. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 48p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005835/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

The methodologies of the uncertainty analysis and data adjustment have been well-developed and widely used abroad since the early 70's. With limited amount of covariance data on the differential cross section and the integral experiments available at the time, their accomplishments are, indeed, astounding. The fundamental adjustment equations, however, remain qualitatively unchanged. For the past few year, extensive efforts on these subjects have also begun at ANL in order to utilize the massive amount of integral experiments accumulated over years to provide the basis for improving the reactor parameters encountered in various design calculations. Pertinent covariance matrices and sensitivity matrices of the existing integral experiments have been evaluated and systematically compiled in the data files along with the cross section covariance data derived from the ENDF-B/V for the 21 group structure currently under consideration. A production code GMADJ that provides the adjusted quantities for a large number of cross section types has been developed by Poenitz for routine applications. The primary purpose of the present paper is to improve understanding of the application oriented issues important to the data adjustment theory and the subsequent usage of the adjusted quantities in the design calculations in support of these activities. 30 refs., 12 figs., 5 tabs.

12856 **(CONF-880911—33) Experiments and analysis for an axially heterogeneous LMR assembly at ZPPR.** Collins, P.J.; Brumbach, S. B. (Argonne National Lab., Idaho Falls, ID (USA)). 1988. Contract W-31109-ENG-38. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005888/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

Experiments in ZPPR-17 provided physics data for a full-scale (700 MWe) axially heterogeneous LMR. Measurements and analysis are reported for control rod worths, reaction rate distributions, gamma dose distribution, sodium void worths and criticality. Agreement between measurement and calculation are generally satisfactory, but the axial heterogeneity did introduce analytical complications. Some calculational methods gave less good agreement with measurements than in previous homogeneous or radially heterogeneous assemblies. 10 refs., 7 figs., 6 tabs.

12857 **(IWGFR—66) Status of national programmes on fast breeder reactors.** (International Atomic Energy Agency, Vienna (Austria). International Working Group on Fast Reactors). Nov 1988. 181p. (CONF-8805249—). NTIS (US Sales Only), PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006405/JAW.

From 21. IAEA annual meeting on the status of national programmes on fast breeder reactors; Seattle, WA, USA (9 May 1988).

The paper presented at the annual meeting, and published here are: Fast breeder reactor development in France during 1987; Status of fast breeder reactor development in the Federal Republic of Germany, Belgium and the Netherlands; A review of the Indian fast reactor programme; A review of the Italian fast reactor programme; A review of the fast reactor programme in Japan; Status of fast reactor activities in the USSR; A review of the United Kingdom fast reactor programme; Status of liquid metal reactor development in the United States of America; Review of activities of the Commission of European Communities relating fast reactors in 1987; European co-operation in the fields of fast reactor research and development---1987 progress report; and A review of fast reactor activities in Switzerland.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

REFER ALSO TO CITATION(S) 12866

12858 **(CONF-880122—18) MMW [multimegawatt] shielding design and analysis.** Olson, A.P. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 24p. NTIS, PC A03 - OSTI. Order Number DE89004289/JAW.

From 5. symposium on space nuclear power systems; Albuquerque, NM, USA (11 Jan 1988).

Reactor shielding for multimegawatt (MMW) space power must satisfy a mass constraint as well as performance specifications for neutron fluence and gamma dose. A minimum mass shield is helpful in attaining the launch mass goal for the entire vehicle, because the shield comprises about 1% to 2% of the total vehicle mass. In addition, the shield internal heating must produce tolerable temperatures. The analysis of shield performance for neutrons and gamma rays is emphasized. Topics addressed include cross section preparation for multigroup 2D S/sub n/-transport analyses, and the results of parametric design studies on shadow shield performance and mass versus key shield design variables such as cone angle, number, placement, and thickness of layers of tungsten, and shield

top radius. Finally, adjoint methods are applied to the shield in order to spatially map its relative contribution to dose reduction, and to provide insight into further design optimization. 7 refs., 2 figs., 3 tabs.

12859 **(JAERI-M—88-162) Verification of standard core management code system for nuclear ship Mutsu.** Suzuki, Takayoshi; Itagaki, Masafumi; Sakai, Tomohiro. (Japan Atomic Energy Research Inst., Mutsu, Aomori (Japan). Mutsu Establishment). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 80p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756566/JAW.

The Department of Nuclear Ship Engineering has been developing a computer code system for the core management of marine reactors, including the MUTSU mainly subjected here. The developed code system, named Standard Core-Management Code System, consists of several codes. The main codes of the system are: (1) ASSEMBLY-SHIP : burn-up dependent few group constant provision code. (2) STEADY-SHIP : three-dimensional detailed nuclear thermal-hydraulic code. (3) BURN-SHIP : burn-up dependent three-dimensional nuclear thermal-hydraulic code. (4) POSEIDON : Xe transient three-dimensional nuclear thermal-hydraulic code. The report describes verification of ASSEMBLY-SHIP, STEADY-SHIP and BURN-SHIP codes in Standard Core-Management Code System using the measured data from the land-loaded MUTSU-core critical experiments in 1970 and the hot-zero-power MUTSU critical test in 1974. The calculated results, such as the neutron flux distribution, the effective multiplication factor and the equivalent control-rod worth curves, agree well with the measured data, resulting in successful verification of the Standard Core-Management Code System for the MUTSU initial core.

12860 **(MLM—3540-Vol.3) Light-Weight Radioisotope Heater Unit Final Safety Analysis Report (LWRHU FSAR): Volume 3, Nuclear Risk Analysis Document.** (EG and G Mound Applied Technologies, Miamisburg, OH (USA); NUS Corp., Gaithersburg, MD (USA)). 30 Nov 1988. Contract AC04-88DP43495;AC01-87NE32134. 43p. (NUS—5153). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005496/JAW.

The Light-Weight Radioisotope Heater Unit (LWRHU) Final Safety Analysis Report (FSAR), Volume 2, Accident Model Document (AMD) describes potential accident scenarios during the Galileo mission and evaluates the response of the LWRHUs to the associated accident environments. Any resulting source terms, consisting of PuO_2 (with Pu-238 the dominant radionuclide), are then described in terms of curies released, particle size distribution, release location, and probabilities. This volume (LWRHU-FSAR, Volume 3, Nuclear Risk Analysis Document (NRAD)) contains the radiological analyses which estimate the consequences of the accident scenarios described in the AMD. It also contains the quantification of mission risks resulting from the LWRHUs based on consideration of all accident scenarios and their probabilities. Estimates of source terms and their characteristics derived in the AMD are used as inputs to the analyses in the NRAD. The Failure Abort Sequence Trees (FASTs) presented in the AMD define events for which source terms occur and quantify them. Based on this information, three types of source term cases (most probable, maximum, and expectation) for each mission phase were developed for use in evaluating the radiological consequences and mission risks. 4 refs., 5 figs., 8 tabs.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 12937, 12953, 12954, 14073

12861 **(NUREG—0304-Vol.13-No.3) Regulatory and technical reports (Abstract Index Journal): Compilation for third quarter 1988, July--September.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services). Dec 1988. 49p. NTIS, PC A03/MF A01 - GPO - OSTI. Order Number TI89005373/JAW.

This journal includes all formal reports in the NUREG series prepared by the NRC staff and contractors; proceedings of conferences and workshops; as well as international agreement reports. The entries in this compilation are indexed for access by title and abstract, secondary report number, personal author, subject, NRC organization for staff and international agreements, contractor, international organization, and licensed facility.

12862 **(NUREG—0386-Digest-4-Rev.11) United States Nuclear Regulatory Commission staff practice and procedure digest: Commission, Appeal Board and Licensing Board decisions, July 1972--March 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of the General Counsel). Dec 1988. 454p. NTIS, PC A20/MF A01 - GPO - OSTI. Order Number TI89005363/JAW.

This Revision 11 of the fourth edition of the NRC Staff Practice and Procedure Digest contains a digest of a number of Commission, Atomic Safety and Licensing Appeal Board, and Atomic Safety and Licensing Board decisions issued during the period from July 1, 1972, to March 31, 1988, interpreting the NRC's Rules of Practice in 10 CFR Part 2. This Revision 11 replaces, in part, earlier editions and supplements and includes appropriate changes reflecting the amendments to the Rules of Practice effective through March 31, 1988.

12863 **(NUREG—0750-Vol.28-Index-1) Indexes to Nuclear Regulatory Commission issuances, July--September 1988.** (Nuclear Regulatory Commission, Washington, DC (USA)). Jan 1989. 53p. NTIS, PC A04/MF A01 - GPO - OSTI. Order Number TI89005986/JAW.

Digests and indexes for issuances of the Commission (CLI), the Atomic Safety and Licensing Appeal Panel (ALAB), the Atomic Safety and Licensing Board Panel (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions of Rulemaking are presented in this document. These information elements are displayed in one or more of five separate formats. These formats are case name index, digests and headers, legal citations index, subject index and facility index.

12864 **(NUREG—0940-Vol.7-No.3) Enforcement actions: Significant actions resolved: Quarterly progress report, July--September 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Enforcement). Dec 1988. 356p. NTIS, PC A16/MF A01 - GPO - OSTI. Order Number TI89005004/JAW.

This compilation summarizes significant enforcement actions that have been resolved during one quarterly period (July--September 1988) and includes copies of letters, Notices, and Orders sent by the Nuclear Regulatory Commission to licensees with respect to these enforcement actions. It is anticipated that the information in this publication will be widely disseminated to managers and employees engaged in activities licensed by the NRC, so that actions can be taken to improve safety by avoiding future violations similar to those described in this publication.

2108 Economics

12865 (UTNL-R—212, pp 73-89) **Heat supply from nuclear power plants in the United States.** Roe, K.K.; Oliker, I. (Burns and Roe, Inc., Oradell, NJ (USA)). Nov 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780050/JAW. (CONF-8709395—).

From Adhoc nuclear workshop: nuclear electric power base in the Asia-Pacific; Tokyo, Japan (4 Sep 1987).

Nuclear energy is regarded as competitive for urban district heating applications. Hot water heat transport systems of up to 80 km are feasible for heat loads over 1500 MWt, and heat load density of over 50 MWt/km/sup 2/ is most suitable for nuclear applications. An incremental approach and a nuclear plant design provision for future heat extraction are recommended. Nuclear district heating technology status is discussed and results of a study for retrofitting a major existing nuclear power plant to cogeneration operation are presented. Reactor siting and radioactivity decoupling are also discussed.

12866 (UTNL-R—212, pp 98-103) **Economics of the modular reactor as new-generation nuclear power.** Hattori, Sadao. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Nov 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780050/JAW. (CONF-8709395—).

From Adhoc nuclear workshop: nuclear electric power base in the Asia-Pacific; Tokyo, Japan (4 Sep 1987).

This paper lists thirteen advantages which could be effectuated by modular reactors. These advantages are derived basically from the general attributes of modularization, i.e., continuity of production, smallness of size/capacity, ease of standardization, and built-in passive safety. This paper also suggests a general direction in which the development of modular reactors evolve, and a possible nuclear application where modular reactors be effectively utilized.

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 12854, 12855, 12856

12867 **(AECL—7405) NRU analysis support experiments performed in ZED-2. Description of experiments and results: part 2.** Arbique, G.M.; French, P.M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.; Atomic Energy Control Board, Ottawa, Ontario (Canada). Advisory Committee on Nuclear Safety). (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1985. 58p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88704976/JAW.

A series of measurements have been performed in ZED-2 to investigate voiding in a simulated NRU loop site containing uniform and non-uniform UO/sub 2/ fuel strings. The objective of the measurements was to provide experimental data to validate NRU reactor physics codes. Using a simulated NRU loop site containing various UO/sub 2/ fuel strings, in a simulated NRU lattice in ZED-2, measurements were made of: (a) reactivity effects, as measured by critical height changes, associated with the loop site and its contents, (b) detailed and macroscopic flux shapes at the loop site and throughout the lattice, respectively, and (c) Westcott spectral parameters. The report describes and presents the results of the experiments and is the second of a two part set of reports on this series of measurements. 6 refs.

12868 **(CNIC—00087) Using Monte Carlo Method to calculate the neutron distribution within fuel assembly for PWR.** Jiao Huixian. (Research Inst. of Nuclear Power Operation, Wuhan, HB (China)). (China Nuclear Information Centre, Beijing, BJ). Dec 1987. 20p. (In Chinese). (RINPO—0001). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705042/JAW.

Considering fuel assembly for PWR, it is possessed of dense lattice, complex geometry and strong absorption of neutron. To calculate the neutron distribution, in this case, the rather big errors would occur if the diffusion theory were used. However, Monte Carlo Method is suitable for dealing with the problem. By adopting the physics mode given in this thesis, the accuracy of computed results is within experimental errors if the number of computed neutrons is large enough. The precision of physics mode given in this thesis has been proved by lots of physics experiments done in many countries in the world, and it has been adopted for physics design in China. In treating the scattering collision in thermal energy region, anisotropy scatter and the effect of chemical bond between moleculaes are both considered. For the scattering collision in high energy region, inelastic scatter is also taken into account.

12869 **(INIS-BR—1370) Implantation, evaluation and improvement of the diffusion code package developed by the RISO Research Center.** Koide, M.C.M. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). 1983. 272p. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS. Order Number DE88705166/JAW.

The evaluation and improvement of the diffusion code package developed by the RISO Research Center of Denmark have been performed. The improvements made in the package consisted in the presentation of their manuals. In order to reduce the process time of the codes an analytical boundary condition capable of representing the effects of the baffle and the reflector on the flux distribution has been calculated. Such boundary condition was obtained using a one-dimensional medium in the framework of the two group diffusion theory. The results showed that the application of this boundary condition produces very accurate results and an appreciable economy of processing time.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 12915, 12923, 13299

12870 **(CONF-8810155—26) SHAM: High-level seismic tests of piping at the HDR.** Kot, C.A.; Srinivasan, M.G.; Hsieh, B.J.; Malcher, L.; Schrammel, D.; Steinhilber, H.; Costello, J.F. (Argonne National Lab., IL (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.); Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Darmstadt (Germany, F.R.). Inst. fuer Betriebsfestigkeit; Nuclear Regulatory Commission, Washington, DC (USA)). 1988. Contract W-31109-ENG-38. 24p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004285/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

As part of the second phase of vibrational/earthquake investigations at the HDR (Heissdampfreaktor) Test Facility in Kahl/Main, FRG, high-level simulated seismic tests (SHAM) were performed during April--May 1988 on the VKL (Versuchskreislauf) inplant piping system with two servohydraulic actuators, each capable of generating 40 tons of force. The purpose of these experiments was to study the behavior of piping subjected to seismic excitation levels that exceed design levels manifold and may result in failure/plastification of pipe supports and pipe elements, and to establish seismic margins for piping and pipe supports. The performance of six different dynamic pipe support systems was compared in these tests and the response, operability, and fragility of dynamic supports and of a typical US gate valve were investigated. Data obtained in the tests are used to validate analysis methods. Very preliminary evaluations lead to the observation that, in general, failures of dynamic supports (in particular snubbers) occur only at load levels that substantially exceed the design capacity. Pipe strains at load levels exceeding the design level threefold are quite small, and even when exceeding the design level eightfold are quite tolerable. Hence, under seismic loading, even at extreme levels and in spite of multiple support failures, pipe failure is unlikely. 5 refs., 16 figs.

12871 **(IAEA-R—4784-F) Microcomputer-based adaptive control for nuclear steam generator water level control. Final report for the period 1 July 1987 - 30 June 1988.** Hee Cheon No. (Korea Advanced Inst. of Science and Technology, Seoul (Republic of Korea)). (International Atomic Energy Agency, Vienna (Austria)). Aug 1988. 29p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705331/JAW.

A new approach is proposed here for the level control of steam generators through a weighted one-step-ahead stochastic self-tuning algorithm. The complicated steam generator model is represented by four parameters: water level, feedwater flow, steam flow and stochastic disturbances. A set of time series difference equations are obtained by comoining these parameters and the measurements of water level, feedwater flow, and steam flow. These parameters are determined by a recursive least squares algorithm and d-step-ahead optimal prediction of output. This algorithm contains

a forgetting factor which can be used to account for an exponential decay of past data in tracking a slow drift in the parameters. Control input is calculated by using the time series difference equation so that the d-step-ahead optimal prediction of output may equal desired output. An additional integral action controller is adopted optionally to compensate for the steady-state offset which comes from non-zero mean disturbances or control input weighting. The experimental loop, which is a mock-up of the secondary loop of the nuclear power plant, is used to prove the effectiveness of the present adaptive control algorithm. It can be concluded from experimental results that the present weighted d-step-ahead stochastic control scheme is robust and more effective than perfect controllers or PI controllers. 6 refs, 10 figs.

12872 **Automatically closing swing gate closure assembly.** Chang, S.C.; Schuck, W.J.; Gilmore, R.F. (to Dept. of Energy, Washington, DC). US Patent 4,762,666. 9 Aug 1988. Filed date 28 May 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a nuclear reactor tip of assembly, comprising: (a) a nozzle; (b) a closure assembly body connected to the nozzle and having an inlet adjacent the nozzle, an outlet adapted to receive a nozzle cap, and a through bore connecting the inlet and outlet. The inlet, outlet and through bore being dimensioned to permit passage of a fuel charge driven by fluid pressure in the nozzle from the nozzle through the inlet, through bore, and outlet; (c) a swing gate in the body and moveable between a first position in which the swing gate does not seal the through bore and a second position in which the swing gate seals the through bore. The swing gate being moved to the first position by the fuel charge during the passage; and (d) means in the body and in fluid communication with the inlet for hydraulically moving the swing gate to the second position in the absence of the fuel charge regardless of the presence of the fluid pressure in the closure assembly.

12873 **Leakage flow-induced vibration of an eccentric tube-in-tube slip joint.** Mulcahy, T.M. (Materials and Components Technology Division, Argonne National Laboratory, Argonne, IL (US));. pp v of Flow-induced vibrations-1987. Au-Yang, M.K.; Chen, S.S. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870636—).

From 5. national congress on pressure vessels and piping; San Diego, CA, USA (28 Jun 1987).

Eccentricity of a specific slip-joint design separating two cantilevered, telescoping tubes did not create any self-excited lateral vibrations that had not been observed previously for a concentric slip joint. In fact, the eccentricity made instabilities less likely to occur, but only marginally. Most important, design rules previously established to avoid instabilities for the concentric slip joint remain valid for the eccentric slip joint.

2203 Fuel Elements

12874 **(AECL—7920) Tests to determine the release of short-lived fission products from UO/sub 2/ fuel operating at linear powers of 45 and 60 kW/m. Methods and results.** Hastings, I.J.; Hunt, C.E.L.; Lipsett, J.J.; MacDonald, R.D. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1985. 47p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704977/JAW.

Experiments have been carried out using a 'sweep gas' technique to determine the behaviour of short-lived fission products within operating, intact UO/sub 2/ fuel elements. The Zircaloy-4-clad elements were 600 mm long and contained fuel of density 10.65 - 10.71 Mg/m/sup 3/. A He-2% H/sub 2/ carrier gas swept gaseous or volatile fission products out of the operating fuel element past a gamma spectrometer for measurement. We outline our loop model and give full details of calculational procedures. In tests at linear powers of 45 (FIO-122) and 60 kW/m (FIO-124) to a maximum burnup of 80 MW.h/kg U, the species measured directly at the spectrometer during normal operation were generally the short-lived xenons and kryptons. Iodines were not observed during normal operation. The behaviour of I-133 and I-135 was deduced from the decay of Xe-133 and Xe-135 during reactor shutdowns. Plots of R/B (released/born) against λ (decay constant) or effective λ for all isotopes observed at 45 and 60 kW/m show that a line of slope -0.5, corresponding with diffusion kinetics, is a good fit to the measured xenon and krypton data. The inferred release of iodine fits the same line. From this we can extrapolate to an R/B for I-131 of about 5 x 10/sup -4/ at 45 kW/m, and 3 x 10/sup -3/ at 60 kW/m. Both tests were terminated by defects. Under defect conditions, R/B dependence on λ was about 0.6. I-131 release under defect conditions was 5 Ci and 60 mCi for FIO-122 and FI0-124, respectively. 22 refs.

12875 **(CNIC—00154) Controlled porosity UO/sub 2/ fuel pellets.** Zou Congpei; Li Guorong; Lu Huaichang; Gao Dihua. (Southwest Inst. of Nuclear Reactor Engineering, SC (China)). (China Nuclear Information Centre, Beijing, BJ). Jan 1988. 6p. (In Chinese). (SINRE—0012). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705061/JAW.

The microstructure of UO/sub 2/ fuel pellets plays a crucial role in determining its demensional behaviour in the reactor. The use of U/sub 3/O/sub 8/ additive can improve the pellet microstructure, but result in decrease of pellet density and increase of open porosity, which contributes strongly to moisture. So, it is necessary to a dopt very sinterable UO/sub 2/ podwer and suitable pelleting and sintering conditions to minimize open porosity and small porosity.

12876 (EPRI-EL—5807-SR, pp 3.2.1-3.2.5) **Mathematical model of bubble evolution: Materials characteristics.** Rouse, T.O. Jun 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88011930/JAW. (CONF-871290—).

From Transformer overload and bubble evolution; Palo Alto, CA, USA (8 Dec 1987).

Generation of effective scenarios from an analytical model of the type being considered in this discussion requires that there be reliable analytical descriptions of the physical behavior of the materials involved. In the initial approach, several assumptions were made about the behavior of water and of water vapor and other gases in the transformer oil-cellulose paper system. The results of a recent re-evaluation of these assumptions are reported. 10 refs., 1 tab.

12877 **(INIS-BR—1376) Application of photoelasticity to study stress in component of the fuel element of nuclear reator.** Diniz, S.M.C. (Minas Gerais Univ., Belo Horizonte (Brazil). Curso de Pos-graduacao em Ciencias e Tecnicas Nucleares). Nov 1987. 237p. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01 - OSTI; INIS. Order Number DE88705172/JAW.

The fuel assembly, in the core of the nuclear reactor, is submitted to a system of forces (weight, buoyancy and hydraulic lift-up) with a resultant oriented in the direction of the coolant flow. To assure the assembly stability, under all operation conditions of the nuclear reactor, a holding-down device composed of four leaf springs is used. The safe/operation of the reactor depends on the capacity of such springs to support the maximum loads applied on them. The strictly mathematical methods for stress analysis of these springs are very complex, due to several factors such as: tri-dimensional geometry, changing loading, plastic strains and stress concentration. The stress analysis of these springs was performed using the photoelastic method. This technique has been proved to be adequate to the leaf spring analysis. In order to permit the evaluation of the potentialities of the employed method the Photoelasticity is decribed in its multiples purposes; that is, two-dimensional problems, stress frozen technique and reflection photoelasticity. The results obtained certify the role of the Photoelasticity, as a powerful tool to the stress analyst and to the nuclear industry as well.

12878 **(JAERI-M—88-159) Heterogeneity effect and optimum rod diameter of UO/sub 2/ fuel rod on the criticality.** Sakai, Tomohiro; Naito, Yoshitaka; Komuro, Yuichi. (Japan Information Service, Ltd., Osaka (Japan)). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 22p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756565/JAW.

Critical mass and critical dimension of homogeneous mixture of nuclear material and moderator will not be commonly equal to those of heterogeneous identical material. Critical sizes of square lattices of infinitely long UO/sub 2/ rods with various /sup 235/U enrichment, rod diameter and lattice pitch were calculated so as to obtain the rod diameter which gives a minimum critical size. The criticality calculations resulted that minimum critical uranium mass of homogeneous UO/sub 2/ whoes /sup 235/U enrichment is more than 10 wt% and minimum critical dimension of homogeneous UO/sub 2/ whoes /sup 235/U enrichment is more than 20 wt% became less than those of heterogeneous identical materials, respectively. It is safely concluded that if /sup 235/U enrichment is more than 10 or 20 wt%, criticality data for homogeneous UO/sub 2/ can be applicable to not only homogeneous, also heterogeneous system.

2204 Control Systems

REFER ALSO TO CITATION(S) 12661, 12970

12879 **(BARC—1396) Digital recording system.** Chandra, A.K.; Deshpande, S.V.; Iyer, A.; Vaidya, U.W. (Bhabha Atomic Research Centre, Bombay (India). Reactor Control Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1987. 37p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704990/JAW.

A large number of critical process parameters in nuclear power plants have hitherto been monitored using electromechanical chart recorders. The reducing costs of electronics systems have led to a trend towards modernizing power plant control rooms by computerizing all the panel instrumentation. As a first step, it has been decided to develop a digital recording system to record the values of 48 process parameters. The system as developed and described in this report is more than a replacement for recorders; it offers substantial advantages in terms of lower overall system cost, excellent time resolution, accurate data and absolute synchronization for correlated signals. The system provides high speed recording of 48 process parameters, maintains historical records and permits retrieval and display of archival information on a colour monitor, a plotter and a printer. It is implemented using a front end data acquisition unit connected on a serial link to a PC-XT computer with 20 MB Winchester. The system offers an extremely user friendly man machine interaction, based on a hierarchical paged menu driven scheme. Softwre development for this system has been carried out using the C language. (author). 9 figs.

12880 **(BARC—1405) Fault tolerant microcomputer based alarm annunciator for Dhruva reactor.** Chandra, A.K. (Bhabha Atomic Research Centre, Bombay (India). Reactor Control Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1988. 43p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704996/JAW.

The Dhruva alarm annunciator displays the status of 624 alarm points on an array of display windows using the standard ringback sequence. Recognizing the need for a very high availability, the system is implemented as a fault tolerant configuration. The annunciator is partitioned into three identical units; each unit is implemented using two microcomputers wired in a hot standby mode. In the event of one computer malfunctioning, the standby computer takes over control in a bouncefree transfer. The use of microprocessors has helped built-in flexibility in the system. The system also provides built-in capability to resolve the sequence of occurrence of events and conveys this information to another system for display on a CRT. This report describes the system features, fault tolerant organisation used and the hardware and software developed for the annunciation function. (author). 8 figs.

12881 **(CISE—3136) On-line instrumental system for surveillance of nuclear power plant settlements.** Rossini, T.; Vanoli, G.; Mirone, M.; Saveri, E. (Centro Informazioni Studi Esperienze, Milan (Italy)). May 1986. 15p. (CONF-8605355—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780022/JAW.

From 2. international conference on on-line surveillance and monitoring; Venice, Italy (1 May 1986).

The system consists of settlement measurement instruments designed on the principle of communicating vessels. The signal from the vessels are transmitted, by optic-fiber cables, to an automatic acquisition system for data recording and processing. The system allows continuous monitoring and "real-time" evaluation of settlements at selected points of plant structures. This report describes the installation of this instrumentation system in the Caorso nuclear power station and some significant measurements obtained by the system during its first operational period. Design activities are in progress for a next installation of the system in Montalto di Castro nuclear power station currently in the course of construction.

12882 **(CNIC—00144) New method for continuously monitoring leakage of primary coolant into second circuit in reactor.** Yang Guangli; Liu Zhengxin; Gong Deyin. (Beijing Inst. of Nuclear Engineering, BJ (China)). (China Nuclear Information Centre, Beijing, BJ). Jan 1988. 9p. (In Chinese). (BINE—0006). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705057/JAW.

A new method, the nitrogen 16 measurement method for monitoring the leakage of the primary coolant into the second circuit in the reactor has been presented. The experiment which had performed at the primary circuit sampling tube of the heavy water reactor of Institute of Atomic Energy (Beijing) indicates that the sensitivity of this method is higher than the total γ measurement method which is used at present. The detector of this type can be worked at high γ radiation background up to several 2.58 x 10/sup -10/C/(kgcenter dots). When the leakage event took place, its locating specificity is fine. This method can be used to monitor the leakage of the primary coolant into the second circuit in the water reactor (LWR or HWR) especially appropriates for nuclear heating reactor and other reactors in which a smaller volume of middle circuit is equiped.

12883 **(EGG-M—01088) Effectively processing and displaying alarm information.** Corsberg, D. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 5p. (CONF-880633—10). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005178/JAW.

From 4. international conference on human factors and power plants; Monterey, CA, USA (5 Jun 1988).

The problems inherent to current alarm displays in power plants are well documented. Unfortunately, practical solutions have been slow in coming. This paper discusses issues involved in the installation of a CRT-based alarm display at a nuclear power plant and a chemical processing facility. This alarm display is closely coupled with a knowledge-based aid called the Alarm Filtering System (AFS). A comparison of process characteristics to alarm display problems is made. Barriers to the integration of advanced operator aids are described and addressed. 13 refs., 1 fig.

12884 **(EPRI-NP—6083) Oxygen control in PWR secondary coolant: Final report.** Oliker, I.; Shaikh, B. (Electric Power Research Inst., Palo Alto, CA (USA); Burns and Roe, Inc., Oradell, NJ (USA)). Dec 1988. 53p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004712/JAW.

The objective of the study is to assess the technical aspects of utilizing direct contact heaters in the condensate train and a bubbling deaerating device in the condenser in order to improve the deaeration in the feedwater system, and develop cost estimates for such a plant retrofit. A reference PWR plant has been used to establish a basis for development of retrofit requirements and system costs. Emphasis has been placed on retrofitting the existing low pressure heaters in the condenser neck into direct contact heaters in order to improve the condensate deaeration at the very beginning

of the condensate-feedwater cycle. Two basic designs of direct contact heater are discussed and their technical benefits are described. Required plant modifications have been developed and improvement in heat rates have been evaluated. Cost estimates have been developed for such a retrofit. Turbine protection against water induction has been addressed at length including recommendations on various protection measures. Incorporation of a bubbling deaerating device into the reference plant has been evaluated, and its cost estimate has been developed. 4 refs., 18 figs., 1 tab.

12885 **(EPRI-NP—6149) Design and operation of a digital low-power feedwater control system for PWRs: Final report.** Singh, G. (Electric Power Research Inst., Palo Alto, CA (USA); Combustion Engineering, Inc., Windsor, CT (USA). Nuclear Power Systems Group). Jan 1989. 162p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005740/JAW.

This report describes the elements of design and the operational results for the Combustion Engineering Digital Low Power Feedwater Control System at the St. Lucie I and II PWR Nuclear Generating plants owned and operated by Florida Power and Light Company. The microprocessor based feedwater system controller was designed to operate at low power levels (2 to 15% power). It was a replacement in this power range to a manual start-up procedure with a switchover to an analog system above the 15% power level. The Digital Low Power Feedwater Control System has proven to be a reliable system that has enhanced primary and secondary stability and has helped avoid four (4) potential trips at St. Lucie I and St. Lucie II in 1987 operations. The detailed descriptions of the digital controller design, testing and implementation in this report are intended to help utilities evaluate the benefits that digital technology could bring to the control of the feedwater system and other areas of control that are now done by manual or analog methods. 5 refs., 32 figs., 12 tabs.

12886 **(INFO—0241) Modelling operator cognitive interactions in nuclear power plant safety evaluation.** Senders, J.W.; Moray, N.; Smiley, A.; Sellen, A. (MMS Man-Machine Systems Consultants Inc., Toronto, Ontario (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Aug 1985. 112p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705139/JAW.

The overall objectives of the study were to review methods which are applicable to the analysis of control room operator cognitive interactions in nuclear plant safety evaluations and to indicate where future research effort in this area should be directed. This report is based on an exhaustive search and review of the literature on NPP (Nuclear Power Plant) operator error, human error, human cognitive function, and on human performance. A number of methods which have been proposed for the estimation of data for probabilistic risk analysis have been examined and have been found wanting. None addresses the problem of diagnosis error per se. Virtually all are concerned with the more easily detected and identified errors of action. None addresses underlying cause and mechanism. It is these mechanisms which must be understood if diagnosis errors and other cognitive errors are to be controlled and predicted. We have attempted to overcome the deficiencies of earlier work and have constructed a model/taxonomy, EXHUME, which we consider to be exhaustive. This construct has proved to be fruitful in organizing our thinking about the kinds of error that can occur and the nature of self-correcting mechanisms, and has guided our thinking in suggesting a research program which can provide the data needed for quantification of cognitive error rates and of the effects of mitigating efforts. In addition a preliminary outline of EMBED, a causal model of error, is given based on general behavioural research into perception, attention, memory, and decision making. 184 refs.

12887 **(INFO—0242) Task analysis methods applicable to control room design review (CDR).** Moray, N.P.; Senders, J.W.; Rhodes, W. (MMS Man-Machine Systems Consultants Inc., Toronto, Ontario (Canada); Rhodes and Associates Ltd., Willowdale, Ontario (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jun 1985. 155p. NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS. Order Number DE88705140/JAW.

This report presents the results of a research study conducted in support of the human factors engineering program of the Atomic Energy Control Board in Canada. It contains five products which may be used by the Atomic Enegy Control Board in relation to Task Analysis of jobs in CANDU nuclear power plants: 1. a detailed method for preparing for a task analysis; 2. a Task Data Form for recording task analysis data; 3. a detailed method for carrying out task analyses; 4. a guide to assessing alternative methods for performing task analyses, if such are proposed by utilities or consultants; and 5. an annotated bibliography on task analysis. In addition, a short explanation of the origins, nature and uses of task analysis is provided, with some examples of its cost effectiveness. 35 refs.

12888 (INIS-SU—12, pp 3-13) **Interactive interaction with an operator in software for the WWER type reactor control system.** Muzylev, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

A dialog subsystem designed for using as a part of WWER type reactor control system softwae and serving for an operator interactive interaction with the in real time system is described. The DIOR language of operator's directive with extended functional possibilities is suggested. Principles of dialog realization in the system are considered.

12889 (INIS-SU—12, pp 14-22) **Using the graphs models for evaluating in-core monitoring systems reliability by the method of imitating simulaton.** Golovanov, M.N.; Zyuzin, N.N.; Levin, G.L.; Chesnokov, A.N. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

An approach for estimation of reliability factors of complex reserved systems at early stages of development using the method of imitating simulation is considered. Different types of models, their merits and lacks are given. Features of in-core monitoring systems and advosability of graph model and graph theory element application for estimating reliability of such systems are shown. The results of investigation of the reliability factors of the reactor monitoring, control and core local protection subsystem are shown.

12890 (INIS-SU—12, pp 117-119) **Control of neutron-physical calculations in the WWER reactor control system.** Zhuravlev, A.N.; Padun, S.P.; Tachennikov, V.N. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

Principles for constructing software of neutron-physical calculations in the WWER-1000 in-core reactor control system at NPP are described. Calculations are carried out in real time of reactor operation with the help of the SM-2M-type computer under specialized monitor control within the frame of a disk operational system of the standard SM-computer software.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 12851, 12907, 12909, 12914, 12934, 12969, 13531, 13532, 13533, 13554, 13592, 13594

12891 **(BNL—41076) Eleventh international CODATA conference, scientific and technical data in a new era, Karlsruhe, Federal Republic of Germany, 26--29 September 1988: Foreign trip report.** Tichler, J.L. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 24p. NTIS, PC A03/MF A01 - OSTI; GPO Dep. Order Number DE89004958/JAW.

Information on release of radioactive materials in airborne and liquid effluents, solid waste shipments and selected operating information from commercial nuclear power plants in the United States is maintained in a computer data base at Brookhaven National Laboratory (BNL) for the United States Nuclear Regulatory Commission (USNRC). The information entered into the data base is obtained from semiannual reports submitted by the operators of the plants to the USNRC in compliance with the USNRC Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants." The data on releases in the calendar year 1986 include information from 69 plants representing 87 reactors and contain approximately 19,000 entries. Since all the information is contained in a computer data base management system, entry and rapidly respond to inquiries about the data set and to generate computer readable subsets of the data. Such a subset is used as input to the computer program which generates the annual report, "Population Dose Commitments Due to Radioactive Releases from Nuclear Power Plant Sites," prepared by Pacific Northwest Laboratory for the USNRC. BNL began maintaining this data base for the USNRC with the 1978 information and has added information to the data base for each succeeding year. An annual report summarizing the information for each year, prepared by BNL, and published by the USNRC, is available to the general public. Prior to 1978, annual reports were prepared by the USNRC and are available for the years 1972–1977; however, the information for these years is not in a computer accessible data base.

12892 **(CNEA-NT—32/86) Micrometeorological study of the Atucha Nuclear Power Plant site.** Berri, G.J.; Robbio, C.A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Gerencia de Proteccion Radiologica y Seguridad). 1986. 77p. (In Spanish). (CNEA-GPRS—6). NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88704945/JAW.

The evaluation of time meteorological data obtained at the micrometeorological station of the Atucha Power Plant during 1979, is presented. Special attention is given to the transport and atmospheric dispersion characteristics through the evaluation of the mean and hourly wind behaviour and the stability classes. Furthermore, it is obtained an estimation of the dispersion factors both for short-term and long-term releases using Gaussians models. As these factors are representative of mean conditions, they should not be applied to the analysis of isolated situations. Finally it is emphasized that, although the results were obtained by means of 1979 data, significative differences are not expected for other years. (M.E.L.).

12893 **(EPRI-NP—6163) On-site storage of low-level radioactive waste at power reactors: An international scoping study: Final report.** Coe, L. (Electric Power Research Inst., Palo Alto, CA (USA); Science Applications International Corp., Rockville, MD (USA)). Dec 1988. 101p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004710/JAW.

This scoping study reviews the on-site storage experience of several foreign utilities whose radwaste management options do not include disposal. Because the future availability and fee structure of US waste disposal are uncertain, US utility companies can benefit from lessons learned from this experience. The study concentrated on radwaste practices in Canada, Europe (primarily Sweden and the Federal Republic of Germany), and the Far East (primarily Japan and Taiwan). 41 refs., 29 figs., 10 tabs.

12894 **(EPRI-NP—6169) A review of plant decontamination methods: 1988 Update: Final report.** Remark, J.F. (Electric Power Research Inst., Palo Alto, CA (USA); Applied Radiological Control, Inc., Marietta, GA (USA)). Jan 1989. 60p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005541/JAW.

This document updates the state-of-the-art in decontamination technology since the publication of the previous review (EPRI NP- 1128) in May 1981. A brief description of the corrosion-film characteristics is presented as well as corrosion film differences between a BWR and PWR. The generation transportation, activation, and deposition of the radioisotopes found throughout the reactor coolant system is also discussed. Successful, well executed, decontamination campaigns are always preceded by meticulous planning and careful procedure preparation which include contingency operations. The Decontamination Planning and Preparation Section describes the technical planning steps as well as the methodology that should be followed in order to select the optimum decontamination technique for a specific application. A review of a number of the decontamination methods commercialized since 1980 is presented. The basic mechanism for each process is described as well as specific applications of the technology in the fields. Where possible, results obtained in the field are presented. The information was obtained from industry vendors as well as personnel at the plant locations that have utilized the technology. 72 refs., 5 tabs.

12895 **(EPRI-NP—6182) Downstream behavior of volatile iodine, cesium, and tellurium fission products: Final report.** Johnson, I.; Farahat, M.K.; Settle, J.L.; Arntzen, J.D.; Johnson, C.E. (Electric Power Research Inst., Palo Alto, CA (USA); Argonne National Lab., IL (USA)). Jan 1989. 114p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005930/JAW.

The downstream behavior of fission product iodine, cesium, and tellurium has been investigated by injecting mixtures of CsI, CsOH, and Te into a superheated steam/hydrogen stream and determining the physical and chemical changes that took place as the gaseous mixture flowed down a 3.65-m (12-ft) long reaction duct on which a temperature gradient (1000{degree}–200{degree}C) had been imposed. Deposition on the wall was found to occur by either reaction with the surface, vapor condensation, or aerosol collection. The deposition processes were influenced by reactions in the gas stream between CsI and CsOH and between Te and CsOH. Revaporization behavior was studied by flowing steam down the duct after deposition and determining the changes in the deposition and determining the changes in the deposition pattern on the wall of the duct. The deposits were characterized by chemical, SEM, and x-ray diffraction analyses. The experimental data were used in modeling the downstream behavior of iodine, cesium, and tellurium in a superheated steam/hydrogen stream. 20 refs., 18 figs., 30 tabs.

12896 **(INFO—0194) Effects of radiogenic heat on groundwater flow.** Beddoes, R.J.; Tammemagi, H.Y. (RE/SPEC Ltd., Calgary, Alberta (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Mar 1986. 99p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705119/JAW.

The effects of radiogenic heat released by a nuclear waste repository on the groundwater flow in the neighbouring rock mass is reviewed. The report presents an overview of the hydrogeologic properties of crystalline rocks in the Canadian Shield and also describes the mathematical theory of groundwater flow and heat transfer in both porous media and fractured rock. Numerical methods for the solution of the governing equations are described. A number of case histories are described where analyses of flow systems have been performed both with and without radiogenic heat sources. A number of relevant topics are reviewed such as the role of the porous medium model, boundary conditions and, most importantly, the role of complex coupled processes where the effects of heat and water flow are intertwined with geochemical and mechanical processes. The implications to radioactive waste disposal are discussed.

12897 **(NUREG/CR—3444-Vol.5) The impact of LWR decontaminations on solidification, waste disposal and associated occupational exposure: Annual report, Fiscal year 1987.** Adams, J.W.; Soo, P. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (USA)). Jun 1988. Contract AC02-76CH00016. 58p. (BNL-NUREG—51699-Vol.5). NTIS, PC A04/MF A01 - GPO - OSTI. Order Number TI89002303/JAW.

A study was carried out to determine the extent of corrosion for a range of low-level waste container materials in contact with simulated resin bead decontamination wastes. The materials included metals and high-density polyethylene. Tests were also conducted on mechanical stability of the decontamination resin wastes, solidi-

fied in cement and vinyl ester-styrene, during thermal cycling between 60{degree}C and {minus}40{degree}C. 12 refs., 20 figs., 12 tabs.

12898 **(SNV—3369) Basis for modelling of radionuclide flow in the Forsmark biotest basin.** Notter, M.; Snoeijs, P.; Argaerde, L.; Elert, M. (Statens Naturvaardsverket, Drottningholm (Sweden); Vaextbiologiska Institutionen, Uppsala (Sweden); Kemakta Konsult AB, Stockholm (Sweden)). (National Swedish Environmental Protection Board, Solna; Kemakta Konsult AB, Stockholm (Sweden)). 1987. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756534/JAW.

Certain radionuclides are discharged together with the cooling water of Forsmark power station. Of these, Mn-54, Co-60, Zn-65 and Ag-110 m are easily detectable in the environment. This report gives a conceptual five-compartment model for the flows of radionuclides within the basin ecosystem. The available data from biological and radio-ecological investigations in the biotest basin were used to quantify the amounts of radionuclides in each of the reservoirs. The subsystem water-sediment-primary producers was pointed out to be the most interesting part of the ecosystem for studying radionuclides with mathematical modelling in the future.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 12912, 12913, 12914, 12918, 12921, 12934, 12951, 12952, 12969

12899 **(CNIC—00161) In-core fuel element temperature and flow measurment of HFETR.** Chen Daolong; Jiang Pei. (Southwest Inst. of Nuclear Reactor Engineering, SC (China)). (China Nuclear Information Centre, Beijing, BJ). Feb 1988. 28p. (In Chinese). (SINRE—0013). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705065/JAW.

The HFETR in-core fuel element temperature-flow measurement facility and its measurement system are expounded. The applications of the instrumented fuel element to stationary and transient states measurements during the lift of power, the operation test of all lifetime at first load, and the deepening burn-up test at second load are described. The method of determination of the hot point temperature under the fin is discussed. The error analysis is made. The fuel element out-of-pile water deprivation test is described. The development of this measurement facility and succesful application have made important contribution to high power and deep burn-up safe operation at two load, in-core fuel element irradiation, and varied investigation of HFETR. After operation at two loads, the integrated power of this instrumented fuel element arrives at 90.88 MWd, its maximum point burn-up is about 64.9%, so that the economy of fuel use of HFETR is raised very much.

12900 **(CONF-8809221—4) Status of the RERTR [Reduced Enrichment Research and Test Reactor] Program.** Travelli, A. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005851/JAW.

From International meeting on reduced enrichment for research and test reactors (RERTR); San Diego, CA, USA (18 Sep 1988).

The progress of the Reduced Enrichment Research and Test Reactor (RERTR) Program is described. After a brief summary of the results which the RERTR Program, in collaboration with its many international partners, had achieved by the end of 1987, the major events, findings and activities of 1988 are reviewed. The US Nuclear Regulatory Commission issued a formal and generic approval of the use of U_3Si_2-Al dispersion fuel in research and test reactors, with densities up to 4.8 g U/cm^3. New significant findings from postirradiation examinations, from ion-beam irradiations, and from analytical modeling, have raised serious doubts about the potential of LEU U_3Si-Al dispersion fuel for applications requiring very high uranium densities and high burnups (>6 g U/cm^3, >50% burnup). As a result of these findings, the fuel development efforts have been redirected towards three new initiatives: (1) a systematic application of ion-beam irradiations to screen new materials; (2) application of Hot Isostatic Pressing (HIP) procedures to produce U_3Si_2-Al plates with high uranium densities and thin uniform cladding; and (3) application of HIP procedures to produce plates with U_3Si wires imbedded in an aluminum matrix, achieving stability, high uranium density, and thin uniform cladding. The new fuel concepts hold the promise of extraordinary performance potential and require approximately five years to develop.

12901 **(EPRI-NP—6174) Simulator Automated Testing and Reverification (SATAR) Program: Functional requirements specification.** Hoeper, P.S.; Pellechi, M.S.; Van Derslice, J.S. (Electric Power Research Inst., Palo Alto, CA (USA); General Physics Corp., Columbia, MD (USA)). Jan 1989. 130p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005929/JAW.

The Simulator Automated Testing & Reverification (SATAR) Program described in this document will permit the user to develop and run, automatically, a sequence of performance tests. The program will collect all the data identified as critical to the selected tests on disk. The data set(s) can then be downloaded to a personal computer for plotting and automatic comparison with baseline data. This program is being developed as part of Electric Power Research Institute (EPRI) Research Project 2054-2, Simulator Qualification Methodology. It can be used to support the research published in EPRI Report NP-5504, Simulator Qualification Plan. 17 figs.

12902 **(FEI—1825) Spectra of neutrons emitted from the channel of BR-10 reactor.** Kolevatov, Yu.I.; Kremenetskij, A.K.; Trykov, L.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1987. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705251/JAW.

The aim of the paper is to measure neutron spectra on the collimator output as well as to determine absolute neutron fluxes normalized to reactor power. The BR-10 fast neutron research reactor in the core of which /sup 235/U is used a fissioning material serves as a neutron source. The main measurements are carried out on the 1 kW reactor power. Counting rates for all multispherical spectrometer transduces for both output collimating openings are measured and normalized N(d) counting rates where d is the diameter of a ball moderator are calculated. All the data obtained are presented in the form of tables. Comparing data on the RB-5 reactor it is inferred that the absolute value of neutron flux density at the B-3 channel output of the BR-10 reactor decreases 2.5 times and definite spectrum hardening occurs. 2 refs.; 1 fig.; 3 tabs.

12903 **(INIS-mf—11346) Evaluation of final vapor pressures in the loss of flow accident in an irradiation device of a pool reactor core.** Verri, A. (ENEA, Casaccia (Italy). Centro Ricerche Energia). (Associazione Termotecnica Italiana, Turin). 1987. 8p. (In Italian). (CONF-8709310—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705275/JAW.

From 42. National Congress of the Italian Thermotechnical Association; Genoa, Italy (8 Sep 1987).

The reliability feature, are described for a device containing samples, at a temperatures of 300 grade centigrades, in a reactor core for a long time. After an examination of the maximum accident event, the maximum vapour pressure originated by the inlet of reactor cooling water into the experimental device, is evaluated.

12904 **(INP—1279/PS) Possibility of quasielastic neutron scattering (QNS) studies on the NSWR spectrometer at the IBR-2 pulse reactor.** Urban, S.; Brankowski, J.; Natkaniec, I.; Olejarczyk, W.; Krawczyk, J.; Pawelczyk, J.; Zaleski, T. (Uniwersytet Jagiellonski, Krakow (Poland). Inst. Fizyki; Joint Inst. for Nuclear Research, Dubna (USSR); Institute of Nuclear Physics, Krakow (Poland)). (Institute of Nuclear Physics, Krakow (Poland)). 1985. 22p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705282/JAW.

Design and the basic physical parameters of the new high resolution neutron spectrometer, NSWR, are presented. It is applicable, among others, to the quasielastic neutron scattering studies

on samples containing hydrogen. Major factors determining the energy resolution of the spectrometer have been analysed and the results confronted with the preliminary experimental tests. It has been found that the spectrometer will be the effective tool in the molecular stochastic processes studies in condensed phases (translational and rotational diffusion of molecules). Effective ranges of the correlation times tau and/or self-diffusion constants accessible to studies are expected to be: 10/sup -13/ s <{similar←to} tau <{similar←to} 10/sup -10/ s 10/sup -7/ cm/sup 2/ s/sup -1/ <{similar←to} D/sub t/ <{similar←to} 10/sup -5/ cm/sup 2/ s/sup -1/. Spectrometer will be installed on the beam No 7 of the pulse reactor IBR-2 at Neutron Physics Laboratory, Joint Institute for Nuclear Research in Dubna. 10 refs., 6 figs., 3 tabs.

12905 **(JAERI-M—88-170) Verification of fuel temperature analysis code 'TEMDIM'.** Maruyama, Soh; Fujimoto, Nozomu; Sudo, Yukio; Fujii, Sadao; Watanabe, Takashi. (Japan Atomic Energy Research Inst., Oarai, Ibaraki. Oarai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Sep 1988. 75p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756570/JAW.

This report presents the verification results of fuel temperature analysis code "TEMDIM" for core thermal and hydraulic design of the High Temperature Engineering Test Reactor (HTTR), which has been designed at the Japan Atomic Energy Research Institute (JAERI). The experimental results obtained by the single-channel test rig of HENDEL fuel stack test section (T/sub 1-s/) were used for the verification of TEMDIM code. The verification results show the adequateness and conservativeness of fuel temperature analysis methods in core thermal and hydraulic design.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 12867, 12916, 12919

12906 **(JAERI-M—88-156) Development of reinstrumenting technique of fuel rods with pressure gages. In and out-of-pile characteristics of developed fission gas pressure gages.** Komori, Yoshihiro; Ohshima, Kunio; Suzuki, Yasuo; Kawamura, Hiroshi; Sakurai, Fumio; Ooka, Kiichi; Saito, Minoru. (Japan Atomic Energy Research Inst., Oarai, Ibaraki. Oarai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 61p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756563/JAW.

Comprehensive procedures were designed in order to reinstrument irradiated fuel rods with fission gas pressure gages and measure inner pressure of the fuel rods in following re-irradiation experiments. The procedures have necessitated development of wide-ranging techniques which have been successfully being carried out. This report outlines the reinstrumenting procedures and summarizes in and out-of-pile characteristics of the developed pressure gage. Efforts were made to provide designed performance in fabrication process, which resulted in several revisions in the pressure gage design. In and out-of-pile performance tests verified successful workability of the developed pressure gage under expected service environments.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 12860, 12880, 12883, 12885, 12894, 12895, 12990, 13555, 13701, 14074, 14076

12907 **(BNL-NUREG—41964) Accident management for severe accidents.** Bari, R.A.; Pratt, W.T.; Lehner, J.; Leonard, M.; Disalvo, R.; Sheron, B. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 8p. (CONF-881014—16). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004899/JAW.

From International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France (2 Oct 1988).

The management of severe accidents in light water reactors is receiving much attention in several countries. The reduction of risk by measures and/or actions that would affect the behavior of a severe accident is discussed. The research program that is being conducted by the US Nuclear Regulatory Commission focuses on both in-vessel accident management and containment and release accident management. The key issues and approaches taken in this program are summarized. 6 refs.

12908 **(CEA-DAS—467) Assessment of the radiological consequences in case of an emergency on a nuclear installation.** Manesse, D.; Crabol, B. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Apr 1988. 7p. (EN, FR). (CONF-8801124—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754934/JAW.

From OECD-NEA/CEC workshop on recent trends in the evaluation of reactor accident consequences; Rome, Italy (25 Jan 1988).

The French Institute for Health Physics and Nuclear Safety (IPSN) has, for emergency cases on nuclear installations, an Emergency Technical Centre (Centre Technique de Crise - CTC) to provide the public authorities with the technical analysis of the events and with information concerning possible developments in terms of potential releases and radiological consequences to the environment. The CTC is connected, by a special line, to the French Meteorological Office so as to have access to meteorological parameters and local forecasts on the nuclear site at all times. For atmospheric dispersion and radiological consequences, three methods have been developed: a set of operational graphs (for first aid), a gaussian plume model and a gaussian puff model (SIROCCO); the latter two models are implanted on a VAX 8530 computer (with graphical monitors) reserved for that purpose.

12909 **(CNIC—00085) Evaluation of release amount of radioactivity from Chernobyl accident and of resulting radiological consequence in China.** Zhang Yongxing. (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). (China Nuclear Information Centre, Beijing, BJ). 1987. 13p. (In Chinese). (IAE—0025). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705040/JAW.

Three kinds of methods are used to evaluate the release amount from Chernobyl RBMK-1000 reactor accident, i.e. (1) estimation by comparison with Windscale accident; (2) estimation in terms of the stock in the core; and (3) estimation according to the available monitoring data form adjacent countries such as Poland and Finland. The results obtained are as follows: the release of I-131 was 0.1-1.5 EBq, which is approximately 4-50% of the stock in the core; the release amount of Ru-103 was comparable to that of Cs-137, both approximately 5-10% of that of I-131; the volatile nuclides such as Mo-99, Ru-103, Te-132, Cs-137 etc., were in the order of 0.4 EBq; involatile nuclides were 0.2 EBq; noble gases and other fission products 10 EBq; and the total amount released was about 20 EBq, which taken together 8% of the stock in the core. The radioactive cloud cluster passed through over the area of China in the beginning of May. It was estimated that the total amount of I-131 in air over China area was about 1.6 PB/sub q/, Cs-137 about 0.3 PB/sub q/, Ru-103 about 0.2 PB/sub q/; the total fallout in the area of China was about 3 PB/sub q/ for I-131, about 0.1 PB/sub q/ for Cs-137, about 0.3 PB/sub q/ for Ru-103. The resulting effective dose equavalent commitment to critical group individual was about 60 μSv, collective effective dose equavalent commitment received by the population of China was about 1 x 10/sup 4/ man.Sv.

12910 **(CNIC—00106) Monitoring on influence of Soviet chernobyl accident on environment of some regions of China.** Song Shaoyi; Liu Xinhua; Wang Huamin; Ban Ying. (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). (China Nuclear Information Centre, Beijing, BJ). 1987. 14p. (In Chinese). (IAE—0031). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705048/JAW.

This paper reports the monitoring results of some environmental samples from Gansu provinces and Qinshan aera of Zhejiang Province and the cities of Beijing, Shenyang and Baotou after the Soviet Chernobyl reactor accident. The samples collected included air, fallout, rain water, reservoir water, plants and soil and

the wipping samples of international and domestic airlines were also measured. Analyese were made by using low background Ge(Li) γ spectrometer with anti-coincident shield and by radiochemical methods for /sup 89/Sr, /sup 90/Sr and Pu contents in some samples. The results indicate that the radioactive cloud released from the Chernobyl accident arrived to Beijing area on May 2, 1986. Generally speaking, the concentration of radioactive cloud in north China was greater than that in south China. Fission products were found in wipping samples taken from airplanes flying over Europe and Asia. The radioactivity level of the samples taken from European air-line was considerably higher than that from Asian airline. The main fission products found in different samples were as follows: /sup 131/I, /sup 137/Cs, /sup 134/Cs, /sup 103/Ru and /sup 132/Te, /sup 132/I. The ratio of /sup 137/Cs to /sup 134/Cs was about 2. The partial effective dose equivalent commitment of preliminary estimation to the public in Beijing area from the accident was 11.3 μSv. The contribution of the external exposure was 7.9 μSv. The contribution of the internal exposure was 3.4 μSv.

12911 **(CONF-880616—5) Thermal effects in concrete containment analysis.** Pfeiffer, P.A.; Kennedy, J.M.; Marchertas, A.H. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005805/JAW.

From 4. workshop on integrity of containments for nuclear power plants; Arlington, VA, USA (14 Jun 1988).

Analyses of the thermo-mechanical response of the 1:6-scale reinforced concrete containment are presented. Three temperature-pressure scenarios are analyzed to complete loss of the pressure integrity. These results are compared to the analysis of pressure alone, to assess the importance of thermal effects. 19 refs., 9 figs., 8 tabs.

12912 **(CONF-8809221—3) Some observations regarding research reactor comparisons to the SPERT transient experiments.** Woodruff, W.L. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005829/JAW.

From International meeting on reduced enrichment for research and test reactors (RERTR); San Diego, CA, USA (18 Sep 1988).

The SPERT I experiments have been used in the Safety Anslysis Reports of many research reactors to define safety limits on the maximum reactivity insertion. Comparisons for selected reactor cores show that transient parameters are quite sensitive to flow channel thickness, reactor size, and the pressure or coolant depth over the core. For example, higher operating pressures can in fact contribute to higher peak clad temperatures. Comparison of current HEU reactor designs with low power and large flow channels and proposed LEU designs show that the LEU designs will provide larger safety margins for reactivity insertions because of a higher void/density feedback and the addition of Doppler feedback. 5 refs., 9 tabs.

12913 **(CONF-8810193—Summ.) Report of the Advanced Neutron Source (ANS) safety workshop, Knoxville, Tennessee, October 25--26, 1988.** Buchanan, J.R.; Dumont, J.N.; Kendrick, C.M.; Row, T.H.; Thompson, P.B.; West, C.D.; Marchaterre, J.F.; Muhlheim, M.D.; McBee, M.R. (comp.). (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 321p. NTIS, PC A14/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005701/JAW.

From Advanced Neutron Source (ANS) safety workshop; Knoxville, TN, USA (25 Oct 1988).

On October 25--26, 1988, about 60 people took part in an Advanced Neutron Source (ANS) Safety Workshop, organized in cooperation with the Oak Ridge Operations (ORO) Office of the Department of Energy (DOE) and held in Knoxville, Tennessee. After a plenary session at which ANS Project staff presented status reports on the ANS design, research and development (R and D), and safety analysis efforts, the workshop broke into three working groups, each covering a different topic: Environmental and Waste Management, Applicable Regulatory Safety Criteria and Goals, and Reactor Concepts. Each group was asked to review the Project's approach to safety-related issues and to provide guidance on future reactor safety needs or directions for the Project. With the help of able chairmen, assisted by reporters and secretarial support, the working groups were extremely successful. Draft reports from each group were prepared before the workshop closed, and the major findings of each group were presented for review and discussion by the entire workshop attendance. This report contains the final version of the group reports, incorporating the results of the overall review by all the workshop participants.

12914 **(DOE/EH—0045) Design review of the High Flux Isotope Reactor.** (USDOE Assistant Secretary for Environment, Safety and Health, Washington, DC. Office of Nuclear Safety). Aug 1987. 286p. NTIS, PC A13/MF A01 - OSTI; 1; GPO Dep. Order Number DE88016373/JAW.

This report represents the results of an assessment of the design of the High Flux Isotope Reactor (HFIR), operated by the Martin Marietta Energy Systems, Inc. (MMES), located at the Oak Ridge National Laboratory (ORNL). The assessment was performed on behalf of the Assistant Secretary for Environment, Safety, and Health (ES and H) and was led by a senior member of the Office of Nuclear Safety. The report is addressed to the facility operating contractor. Thus, the report is written presuming an understanding of the facility processes, systems, and design. An executive summary is contained in Chapter 2 of the report. Chapter 3 is the general plant description. Chapters 4 through 16 contain the findings and recommendations in the areas of evaluation. Recommendations are also provided.

12915 **(DOE-RW—88.043) Report on further development of the Winfrith Modular Containment System and associated equipment.** Sanders, M.J.; Pengelly, M.G.A. (9050785GB;). (Department of the Environment, London (UK)). Mar 1988. 26p. (AEEW-R—2247; PCMRP—87-P10). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755542/JAW.

As a result of operational experience gained with the Winfrith Modular Containment, the need for a lifting aid to facilitate the decommissioning of tall plant, a 2-stage mobile ventilation system and an improved shower entry tunnel was identified. Improved plant and equipment has been designed, constructed and tested and the results are presented here.

12916 **(DP-MS—88-46) Experimental measurements of dropsize distribution in an array of water sprays.** Hightower, N.T. III; Bassett, T.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 20p. (CONF-880815—12). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005322/JAW.

From 20. DOE/NRC nuclear air cleaning conference; Boston, MA, USA (22 Aug 1988).

Experimental measurements of the spatial dropsize distribution (DSD) for a proposed improved reactor spray system (IRSS) array for the Savannah River production reactors were conducted to characterize the spatial DSD at various vertical distances below the tip of the spray nozzles. The grid spacing between the nozzles was varied for the array to investigate the effect of spacing on DSD. Since buffered water is known to enhance the scrubbing effectiveness of sprays, unbuffered water (pH of 7) and buffered water (pH of 10) were used to investigate the effect on DSD. DSD data for the proposed IRSS were necessary to evaluate the effectiveness of gas cooling and radioactive halogen and particulate scrubbing in the reactor room air following a hypothetical severe core-melt accident. The test data will be used in the computer simulation design process of the proposed IRSS for the Savannah River production reactors. The tests represent one of the first full-scale measurements of spatial DSD for a respresentative section of a spray system array in the United States. No known reactor safety spray calculations involving the application of sprays in containment or confinement systems account for the variation of DSD with distance. These tests were an attempt to investigate this phenomenon. The tests are significant due to the widespread application of sprays in the containment or confinement system of nuclear reactors. 10 refs., 12 figs., 6 tabs.

12917 **(EGG-EAST—8264) Thermal-hydraulic response and iodine transport during a steam generator tube rupture.** Callow, R.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1988. Contract AC07-76ID01570. 67p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004947/JAW.

Recent reanalyses of the offsite dose consequences following a steam generator tube rupture have identified a possible non-conservatism in original FSAR analyses. Post-trip uncovery of the top of the steam generator U-tubes, in conjunction with a break near the U-tube top, could lead to increased iodine release due to a reduced "scrubbing" of the iodine in the primary break fluid by the steam generator secondary liquid. To evaluate this issue, analyses were performed at the Idaho National Engineering Laboratory. The RELAP5 computer code was used to conduct an analysis of the Surry plant to determine whether the post-trip steam generator secondary mixture level was sufficient to maintain continuous coverage of the U-tubes. The results indicated continuous coverage of the U-tubes. The RELAP5 result was supported by a hand calculation. Additional RELAP5 analyses were conducted to determine magnitudes of iodine release for a steam generator tube rupture. Two sensitivity studies were conducted. The amount of iodine released to the atmosphere was strongly dependent on the assumed value of the partition coefficient. The assumption of steam generator U-tube uncovery, on a collapsed liquid level basis, following reactor trip had a minor effect on the amount of released iodine. 17 refs., 28 figs., 5 tabs.

12918 **(EGG-EAST—8270) The addition and assessment of condensation heat transfer models to COBRA-NC for improved analyses of current and advanced reactor containments.** Watkins, J.C. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1988. Contract AC07-76ID01570. 68p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004949/JAW.

Although several computer codes exist which offer the ability to simulate the response of containments to hypothesized events, one appears to offer more in the area of best estimate performance during normal operations and following an accident prior to the release of fission products. This computer code is COBRA-NC due to its ability to analyze the containment multi-dimensionally, to track several species of noncondensible gases, entrained liquid and liquid films throughout the containment, and have the ability to analyze the containment in a passive mode of operation when the only driving forces present are due to natural circulation. Objectives specific to this task were to: enhance the ability of COBRA-NC to analyze both current and advanced reactor containments; and assess the ability, stability and biases of the condensation heat transfer correlations which may be used in containment analyses performed by the utilities and their regulators. 23 refs., 21 figs., 2 tabs.

12919 **(EGG-EAST—8273) Loss-of-pumping accident in Savannah River L-Reactor.** Cozzuol, J.M. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1988. Contract AC07-76ID01570. 48p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004948/JAW.

An analysis of a loss-of-pumping accident (LOPA) has been performed using a RELAP5 Model of the Savannah River L-Reactor plant. The analysis showed that the LOPA transient was characterized by an early process system cooldown resulting from reactor trip, followed by a heatup and rapid expulsion of process system coolant once pump availability was lost. Approximately 25,000 kg of coolant left the process system through the supplementary pressure relief system flow path during the period of expulsion. The expulsion of coolant led to a much earlier dryout and heatup of reactor fuel than would be expected from a simple boiloff. Cladding temperature in the peak power region of the core reached 600{degree}C by about 750 seconds. 11 refs., 29 figs., 5 tabs.

12920 **(EGG-M—20987) Creep rupture failure of the reactor vessel hot leg nozzle during the TMLB' accident.** Harris, B.L.; Shah, V.N.; Korth, G.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 30p. (CONF-880661—10). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005420/JAW.

From ASME pressure vessel and piping conference; Pittsburgh, PA, USA (19 Jun 1988).

A study was performed to determine whether primary reactor coolant system components may fail due to creep rupture before failure of the reactor vessel lower head during a severe accident. Creep rupture of a component may reduce the system pressure during a severe accident and also the resulting containment loadings. The reactor vessel hot leg nozzle was chosen for this evaluation. Master creep rupture curves were developed, as were design curves showing the rupture temperature versus time for constant system pressures. The design curves showed that the rupture time was highly sensitive to temperature so an accurate thermal analysis is required in order to accurately predict rupture times. The sensitivity of the creep rupture time to changes in temperature history and to changes in creep rupture properties was evaluated. The study indicates that creep rupture of the nozzle will occur before failure of the lower head, thereby changing the risk associated with a high pressure severe accident sequence. 10 refs., 9 figs., 2 tabs.

12921 **(EGG-M—88067) Design and performance of sampling and monitoring instrumentation for source term integral tests in the Power Burst Facility.** Hartwell, J.K.; Osetek, D.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 10p. (CONF-881014—18). NTIS, PC A02/MF A01 - OSTI; GPO Dep. Order Number DE89005182/JAW.

From International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France (2 Oct 1988).

Instrumentation design engineers at the Idaho National Engineering Laboratory (INEL) have developed measurement and monitoring devices for a number of power and test reactors. This paper discusses equipment developed for experiments conducted in the Power Burst Facility (PBF) at the INEL as part of the Severe Fuel Damage (SFD) Research Program, initiated and sponsored by the US Nuclear Regulatory Commission (NRC) and its international partners. These highly instrumented tests incorporated a sophisticated effluent sampling and monitoring system designed to sample, monitor, and qualify the release of fission products, aerosols, and hydrogen from test bundles subjected to severe fuel damage conditions. 8 refs., 1 fig.

12922 **(EGG-M—88100) Results of an aging-related failure survey of light water safety systems and components.** Meale, B.M.; Satterwhite, D.G.; MacDonald, P.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 16p. (CONF-880824—3). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005428/JAW.

From International nuclear power plant aging symposium; Bethesda, MD, USA (30 Aug 1988).

The collection and evaluation of operating experience data are necessary in determining the effects of aging on the safety of operating nuclear plants. This paper presents the final results of a two-year research effort evaluating aging impacts on components in light water reactor systems. This research was performed as a part of the Nuclear Plant Aging Research program, sponsored by the US Nuclear Regulatory Commission. Two unique types of data analyses were performed. In the first, an aging-survey study, aging-related failure data for fifteen light water reactor systems were obtained from the Nuclear Plant Reliability Data System (NPRDS). These included safety, support, and power conversion systems. A computerized sort of these records classified each record into one of five generic categories, based on the utility's choice of the failure's NPRDS cause category. Systems and components within the systems that were most affected by aging were identified. In the second analysis, information on aging-related reported causes of failures was evaluated for component failures reported to NPRDS for auxiliary feedwater, high pressure injection, service water, and Class 1E electrical power distribution systems. 3 refs., 13 figs., 4 tabs.

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12923 **(EGG-M—88101) Simulation of maintenance effectiveness in repairable systems to control risk due to aging.** Satterwhite, D.G.; Cathey, N.G.; Meale, B.M.; MacDonald, P.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 7p. (CONF-880824—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005281/JAW.

From International nuclear power plant aging symposium; Bethesda, MD, USA (30 Aug 1988).

Time- or cyclic-dependent degradation (aging) processes such as wear, corrosion, and fatigue have caused problems at some of the US reactors. This paper presents a methodology to develop optimum maintenance programs that would help control aging-related risks. The study addresses the predictive behavior of systems containing repairable components as represented in current probabilistic risk assessment (PRA) models. The system model chosen for the study is the Draft NUREG-1150 Surry auxiliary feedwater (AFW) system. The simulation results provide an indication of the periodicity at which the aging effects must be corrected to maintain the system failure probability at or below the calculated levels. When maintenance is allowed to periodically correct the effects of aging, the system failure probability is essentially constant over 60 years. Also, results indicate that the system unreliability is not linearly related to the periodicity of aging correction. Therefore, a plant maintenance program would have significant latitude in developing the desired maintenance periodicity limits. In fact, the calculated values for component maintenance periodicity are of such time intervals that aging control can easily be accommodated by a plant maintenance program. 5 refs., 4 figs., 3 tabs.

12924 **(EGG-M—88148) Analysis of refill phenomena during the TMI-2 accident.** Nomura, Yasushi; Anderson, J.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1 Sep 1988. Contract AC07-76ID01570. 43p. (CONF-881024—7). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005102/JAW.

From TMI-2 accident materials behavior, plant technology and recovery; Washington, DC, United States (30 Oct 1988).

The refill phenomena occurring from 200 min to 217 min during the TMI-2 accident, was analyzed by using measurement data such as the RCS pressure and the pressurizer level. At 200 min the HPI began to inject water into the core, which resulted in a primary system depressurization due to steam condensation, and the pressurizer water drained into the vessel, increasing the core level. It is believed that the core was completely covered by water by about 207 min, when the pressurizer level decrease and the RCS depressurization stopped. Continued HPI injection resulted in increasing hot leg water levels, and the pressurizer level began to increase at about 210 min, when water reached the level of the surgeline entrance to the hot leg. A set of equations describing the refill phenomena, and accounting for compression of the noncondensible gases, have been derived from theoretical considerations, and solutions for water levels throughout the RCS have been obtained to predict the above described incidents during the refill period. 4 refs., 10 figs.

12925 **(EGG-M—88178) Transport package maintenance requirements and operations.** Tyacke, M.J.; Ball, L.J.; Ayers, A.L. Jr.; Hayes, G.R.; Anselmo, A. A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 11p. (CONF-881024—12). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005429/JAW.

From TMI-2 accident materials behavior, plant technology and recovery; Washington, DC, United States (30 Oct 1988).

Transporting the damaged core from the Unit 2 reactor of Three Mile Island (TMI-2) Nuclear Power Station near Harrisburg, PA, to the Idaho National Engineering Laboratory (INEL) near Idaho Falls, ID, has required careful attention to safety of the public. As part of that attention, specially designed casks and railcars, called the NuPac 125-B Rail Cask system, were built to make those shipments. More than 30 rail cask loads of core debris from TMI-2 have been transported across country to INEL without incident resulting from performance of the rail cask or railcar. A contributing factor for this safety record is the comprehensive inspection and maintenance program developed for both the rail casks and railcars. This paper describes the NuPac 125-B rail cask and railcar, and identifies the regulatory requirements governing inspections, preventative maintenance, and quality assurance records. This paper also discusses inspection and maintenance experiences that have resulted in hardware and procedural enhancements. 7 refs., 3 figs., 4 tabs.

12926 **(EGG-M—88203) Radiological conditions and experiences in the TMI-2 Auxiliary Building.** Ruhter, P.E.; Zurliene, W.G. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 21p. (CONF-881024—9). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005402/JAW.

From TMI-2 accident materials behavior, plant technology and recovery; Washington, DC, United States (30 Oct 1988).

Although the radiological conditions following the TMI-2 accident were extraordinary, those that had a potential impact on personnel were largely confined to the Auxiliary and Fuel Handling Building. The most significant pathway was the Letdown and Make-Up and Purification System. Dose rates in some locations in the Aux/Fuel Handling Buildings were in excess of 3 mSv/s (1000 R/h) during the first few days following the accident. They decreased after three to four days and stabilized after about one week. Airborne radioactivity levels were initially due to the release of noble gases, and subsequently due to resuspension of surface contamination. During the first month, the mixture of fission products in the reactor coolant change from one of largely cesium to where the strontium and cesium were about equal in radiological importance. This created some very high beta radiation levels. The significant strontium levels caused the contamination control limit to be reduced to one-half of the pre-accident limit. 5 refs., 6 figs.

12927 **(EGG-M—88249) A scenario of the TMI-2 accident.** Broughton, J.M.; Tolman, E.L.; Kuan, P.; Petti, D. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 49p. (CONF-881024—13). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005414/JAW.

From TMI-2 accident materials behavior, plant technology and recovery; Washington, DC, United States (30 Oct 1988).

This article is the first of a series of three Nuclear Safety articles summarizing the major research findings from the TMI-2 Accident Evaluation Program (AEP) being conducted by EG and G Idaho, Inc. for the US Department of Energy. The focal point of the AEP is to develop a consistent understanding of the core damage progression (accident scenario) during the TMI-2 accident. A synopsis of the accident scenario is presented, describing (1) the initial core degradation leading to a noncoolable, consolidated region of core materials, (2) continued heatup of this material, (3) failure of the crust encasing the molten core material and migration of 15--20 metric tons of molten core material to the core bypass and lower head regions, and (4) interaction of the molten core material with the coolant in the lower plenum and with the vessel head. Fission product release from the fuel during the core damage transient is also discussed. The major TMI-2 research findings are summarized and related to the current understanding of severe accidents. 28 refs., 8 figs.

12928 **(EGG-M—88295) Piping support and gate valve behavior during high level HDR [Heissdampfreaktor] simulated seismic tests.** Steele, R. Jr. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 22p. (CONF-8810155—37). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005410/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

This paper describes a portion of the analysis and results to date from the SHAM seismic research program, in which the USNRC/INEL was a participant. The program was conducted by Kernforschungszentrum Karlsruhe (KfK) at the decommissioned Heissdampfreaktor (HDR) located near Frankfurt in the Federal Republic of Germany (FRG). The research program included the study of the effects of increasing levels of seismic excitation on a full scale, in situ nuclear piping system containing a naturally aged US 8-in. motor-operated gate valve. In all, 51 experiments were conducted with the piping supported by six different piping support systems, including a typical stiff US piping support system made up of snubbers and rigid struts. Earthquake-like displacement histories

were input to servohydraulic shakers attached directly to the piping system. Inputs to the piping system started with a magnitude of 0.6 g ZPA and were stepped up, using the same frequency content, to a maximum of 5 g ZPA. The resulting piping system response produced overload snubber failures and local piping strains of 0.9%. The results of this testing will contribute to the technical basis used for support and development of equipment qualification standards and will help establish the seismic safety margins in piping and piping support system components. 13 figs., 3 tabs.

12929 **(EGG-M—88296) A value impact analysis utilizing PRA techniques combined with a hybrid plant model.** Edson, J.L.; Stillwell, D.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 25p. (CONF-8810155—29). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005088/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

A value impact analysis (VIA) has been performed by the INEL to support a NRC Regulatory Analysis for resolution of Generic Issue (GI) 29, "Bolting Degradation or Failure in Nuclear Power Plants". A VIA for replacing the reactor coolant pressure boundary (RCPB) bolts of BWRs and PWRs was previously prepared by Pacific Northwest Laboratories (PNL) in 1985 under instructions limiting the VIA to the potential for failure of primary pressure boundary bolting. Subsequently the INEL was requested to perform a VIA that included non primary systems and components support bolts to be compatible with the resolution of the broader issue. Because the initial list of systems and bolting applications that could be included in the VIA was very large, including them all in the VIA would likely result in analyzing some that have little if any effect on public risk. This paper discusses how PRA techniques combined with a hybrid plant model were used to determine which bolts have the potential to be significant contributors to public risk if they were to fail, and therefore were included in the VIA. 7 refs., 6 tabs.

12930 **(EGG-M—88307) Containment venting as an accident management strategy.** Dallman, R.J.; Galyean, W.J.; Wagner, K.C. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 18p. (CONF-8810155—36). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005404/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

The idea of primary containment venting to prevent or mitigate the consequences from a severe accident is not new. Research has been conducted on filter effectiveness for over thirty years. United States production reactors have had containment filter systems and applications to commercial facilities have been studied over the same period. In Europe, the countries with the largest nuclear power production (France, Germany, and Sweden) all have filtered containment venting systems installed or planned on their nuclear power plants (NPPs). Boiling water reactors (BWRs) in the United States are operated based in part on Emergency Procedure Guidelines (EPGs) which call for wetwell and drywell venting under some circumstances. With increased interest in the management of severe accidents, containment venting as an accident management strategy has experienced new interest, and more detailed evaluations are being performed. Areas being investigated include the capability to reduce hydrogen concentrations, the effect on other systems or proposed modifications, the cost-effectiveness of venting, and its net risk benefit. One of the most comprehensive studies of containment venting was performed on the Peach Bottom Atomic Power Station, a BWR with a Mark I containment. A main conclusion from that study was that based on the draft procedures and equipment in place at the time of the analysis, containment venting had limited potential for further reducing the risk associated with accident sequences currently identified as being important to risk. In the draft Reactor Risk Reference Document, NUREG-1150, venting along with consideration of alternate injection sources was credited with lowering the core damage frequency due to accident sequences, which include a loss of long-term decay heat removal, to less than 1E-8 per reactor year. That result made these sequences insignificant compared to other risk contributors for Peach Bottom. 13 refs., 6 figs.

12931 **(EGG-M—88309) Depressurization to mitigate direct containment heating.** Chambers, R.; Hanson, D.J.; Dallman, R.J.; Odar, F. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 14p. (CONF-8810155—33). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005355/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

Calculations are being performed to bound the system pressure and the time of lower head failure during a station blackout sequence in a 3-loop pressurized water reactor using the SCDAP/RELAP5 computer code. Failure of the pressurizer surge line from creep rupture was predicted prior to lower head failure. To bound the system pressure response from a pressure boundary failure, calculations, extending to the time the accumulators had emptied, have been performed. Calculations bounding in-core damage progression prior to relocation of molten material to the lower plenum have also been completed. Heat transfer to the coolant was maximized and minimized by varying in-core relocation and fragmentation parameters within their uncertainty ranges. The system pressure was lowered significantly, but core damage was extensive. The system pressure was not strongly influenced by the progression of core melt. However, the extent of the molten pool was strongly affected by variation of in-core damage progression parameters. Calculations are planned to bound the pressure and timing of lower head failure by applying reasonable bounds to the porosity of the debris as it moves into the lower plenum. 6 refs., 6 figs., 3 tabs.

12932 **(EGG-M—88312) Quantifying reactor safety margins: Part 2, Characterization of important contributors to uncertainty.** Wilson, G.E.; Boyack, B.E.; Duffey, R.B.; Griffith, P.; Katsma, K.R.; Lellouche, G.S.; Levy, S.; Rohatgi, U.S.; Wulff, W.; Zuber, N. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 26p. (CONF-8810155—35). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005403/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

The NRC has issued a revised ECCS rule which allows the use of best estimate computer codes for safety analysis, providing the uncertainty of the calculations are quantified and compared with acceptance limits contained in 10 CFR Part 50. To support the revised rule, the NRC and its contractors and consultants have developed and demonstrated a methodology to quantify uncertainty called CSAU (Code Scaling, Applicability and Uncertainty). The methodology consists of three primary elements containing 14 Steps. The first element, "Requirements and Capabilities," which contains the first six steps, is described and demonstrated in this paper. The objective of this element is to characterize the important contributors to uncertainty. The objective is accomplished by determining the applicability of a code to analysis of a transient in a Nuclear Power Plant through comparison of the scenario- and plant-dictated requirements with the simulation capabilities of the code. 13 refs., 7 figs., 4 tabs.

12933 **(EGG-M—88354) Thermal interactions during the TMI-2 2-B coolant pump transient.** Kuan, P.; Anderson, J.L.; Tolman, E.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 48p. (CONF-881024—10). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005431/JAW.

From TMI-2 accident materials behavior, plant technology and recovery; Washington, DC, United States (30 Oct 1988).

System pressure response was used to calculate the energy transferred from the reactor core to the coolant during the TMI-2 2-B coolant pump transient. Steam generation rate was also calculated and then used to calculate the heating of the plenum assembly. Energy balance calculations indicate that exothermic oxidation of Zircaloy by steam must have taken place. During the oxidation process, hydrogen would have evolved. In the calculations of plenum assembly heating, the thermal emissivity of steam was artificially reduced to simulate the effect of hydrogen that was mixed with the steam. The calculations show that in the presence of an appreciable amount of hydrogen ({approximately}60%), only the thin structures at the lower end of the plenum assembly would have melted, while the relatively thick structures would have been

partially ablated. These results are consistent with the observed damage. 8 refs., 15 figs., 5 tabs.

12934 **(EGG-M—88398) Results from the Power Burst Facility Severe Fuel Damage Test 1-4.** Petti, D.A.; Allison, C.M.; Martinson, Z.R.; Osetek, D.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 10p. (CONF-881014—17). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005186/JAW.

From International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France (2 Oct 1988).

The Severe Fuel Damage Test 1-4 (SFD 1-4) was conducted in the Power Burst Facility (PBF) at the Idaho National Engineering Laboratory on February 7, 1985. The test was the last in a series of four in-pile tests performed in the PBF as part of an internationally sponsored light water severe fuel damage research program initiated by the US Nuclear Regulatory Commission (NRC). The objective of the PBF SFD program was to contribute to the understanding of fuel and control rod behavior; hydrogen generation; and fission product and aerosol release, transport and deposition during a severe reactor accident. In addition, the data will aid in the development and assessment of detailed computer codes and in resolving some of the outstanding NRC safety issues related to severe reactor accidents. 8 refs., 7 figs.

12935 **(ENEA-RT-SAG—87-1) Research nuclear reactor RB-1: decommissioning safety report.** Cucchi, G.; Giacobbi, V. (ENEA, Rome (Italy)). Mar 1988. 20p. (In Italian). (CONF-871018—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755379/JAW.

From International decommissioning symposium; Pittsburgh, PA, USA (4 Oct 1987).

The induced radioactivity of the reactor structural elements was calculated and the values foreseen by the designers were compared with the ones directly measured on samples taken from the reactor. The induced radioactivity was calculatedtaking account the various lattices employed (Graphite, Orgel, Cirene, THO2-UO2). The radiological control consisted in gamma spectrometry activation measurements, in beta activation measurements and in fixed and removable contamination measurements. The activation measurements were conducted on samples taken from the reactor vessel, structural elements and graphite.

12936 **(ENEA-RT-TERM—86-7) Trend analysis of scrams at Caorso NPP, Italy.** Basso, G.; Fusari, W.; Zanussi, G.; Nobile, M.; Fiori, S.M., Morandi, G. (ENEA, Rome (Italy)). Sep 1986. 15p. (CONF-860453—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755388/JAW.

From Symposium on reducing reactor scram frequency; Tokyo, Japan (14 Apr 1986).

Relevant information is given for each of the 93 scrams which have occurred up to the end of 1985 at Caorso NPP. An analysis, based on the scram initiating signals and root causes, is performed. A more detailed analysis is made for the two root causes which mainly contribute to the scram frequency. The effect of the measures taken to reduce the scram frequency is given together with the current efforts.

12937 (IAEA-TC—610, pp 179-202) **Current status of research and regulation relevant to reactivity initiated accident in Japan.** Fujishiro, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

Along with the rapid increase of nuclear power production in the 1970s, the importance of safety research was recognized in Japan. A domestic research plan was developed for a reactivity initiated accident (RIA) as well as LOCA. For RIA, the NSRR program was proposed to be conducted at the Japan Atomic Energy Research Institute. The project was initiated in 1972 to investigate fuel behaviour during an RIA and to construct a data base for establishing a regulatory guideline for an RIA. Although the program was planned to deal with both LWR and FBR experiments, research on LWR fuels preceded. Over 800 experiments have been conducted in the NSRR and the data base for RIA fuel behaviour for establishing various test parameters. "Evaluation Guideline for Reactivity Initiated Events in Light Water Power Reactor" was issued by the Nuclear Safety Commission based on the knowledge obtained in the NSRR program as well as in the SPERT and PBF programs. As the second phase of the NSRR program, experiments with previously irradiated fuel rods are planned to start in FY 1988. In the third phase, FBR fuel experiments will be conducted in the early 1990s. The results will also be incorporated in the future RIA guideline. 10 refs, figs and tabs.

12938 (IAEA-TC—610, pp 121-136) **Review of reactivity transients and reactivity initiated accidents in Indian power reactors.** Chaudhary, V.N. (Bhabha Atomic Research Centre, Bombay (India)). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

This paper gives a review of the analytical work done pertaining to reactivity transients and reactivity initiated accidents in Indian Boiling Water Reactor (BWR) and pressurised Heavy Water Reactors (PHWRS). For BWR the accidents considered are the rod drop, continuous rod withdrawal and cold water addition. For PHWRS the accidents evaluated are loss of regulation and loss of coolant accident. Failure of reactor protection is also considered to assess the consequences. (author). 8 refs, tabs.

12939 (IAEA-TC—610, pp 203-218) **Status of RIA analysis at JINS.** Hirukawa, K.; Shimegi, N.; Haga, T. (Japan Inst. of Nuclear Safety, Tokyo (Japan). Nuclear Power Engineering Test Center). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

The outline of RIA (Reactivity Initiated Accident) analysis in Japan is briefly reviewed in the beginning, describing the background philosophy of the safety examination standards on this matter. The present status of RIA analysis codes at JINS (Japan Institute of Nuclear Safety) is then briefly described, showing some examples of trial calculations on a typical 1,100 MWe BWR. The JINS' RIA analyses are based on the two computer codes, EUREKA-JINS and EUREKA-JINS/S; the former is for a point reactor kinetic model, while the latter is for a three dimensional space reactor kinetic model. The detailed thermal-hydraulic model has been considered in the EUREKA-JINS, and it has been used for many RIA analyses up to this time. Recently, the space kinetic code EUREKA-JINS/S has also been added to carry out the best-estimate oriented and more detailed analysis. This report describes the outline of these codes, together with some discussions on the results of trial calculations. (author). 16 refs, 5 figs, 3 tabs.

12940 (IAEA-TC—610, pp 260-271) **Treatment of reactivity accidents in LWRs by the USNRC. An overview.** Speis, T.P. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

12941 (IAEA-TC—610, pp 59-82) **Developments concerning reactivity accidents in PWRs.** Gouffon, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

After placing the development work on reactivity accidents in the various actions decided upon further to the Chernobyl accident, this note describes the first results obtained and the further developments. As a general rule, the Chernobyl accident has not provided, from a strictly technical viewpoint, any fundamentally new material which had previously been unknown. Analyses have made it possible to more clearly establish the safety importance of certain operating rules, in particular concerning handling within coolant system pumps. They have not shown the need to modify the design of the French PWRs. This development work must be continued to gain a fuller understanding of the behaviour of fuel, especially after irradiation and power cycling. (author). 3 figs.

12942 (IAEA-TC—610, pp 103-120) **Status and plans of activities relevant to safety aspects of reactivity-initiated transients in the GDR (Survey).** Hoehn, J.; Janke, R.; Mertins, M. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

In the GDR, there are five reactors in operation, one WWER-70 unit with 70 MW(e) and four WWER-440 units with 440 MW(e). A new generation of WWER plants with advanced technological and safety systems and higher power density are under construction. In connection with RIT safety-related work has to be carried out to complete the accident analysis of the design documents, to verify during commissioning safety-relevant parameters of new units, to estimate necessary changes in operation and design throughout the lifetime of the plant and to cope with operational occurrences. To perform this work two main tasks have to be fulfilled: Firstly, analysis of the reactivity behaviour of the WWER core in all steady operational states. Secondly, analysis of possible RIT over the whole period of time to show that these dynamic processes will be under control or to identify accidents beyond DBA. Here, experimentally proven computer codes (CC) are of great importance. 13 refs, 3 figs.

12943 (IAEA-TC—610, pp 272-330) **Rod ejection accident: A review of the accident including calculational methods.** Diamond, D.J. (Brookhaven National Lab., Upton, NY (USA)). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

A review is given of the control rod ejection accident in a pressurized water reactor. The event is described as is plant design which helps prevent or mitigate the accident. Regulatory requirements for analyzing the event are explained. The bulk of the review is then spent on one part of this analysis, namely, the determination of fuel enthalpy and temperature. The way in which the three principal PWR vendors do their calculations is summarized and alternatives are suggested. Lastly, sample results of analyses are presented. (author). 13 refs, figs, 3 tabs.

12944 (IAEA-TC—610, pp 331-337) **Problems of modelling reactivity transients in safety analysis for WWER power plants.** Mysenkov, A.I.; Kalinenko, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

The authors consider the problems of safety of power plants with WWER reactors in accident situations with reactivity transients and the initiating primary events which are analysed in connection with safety verification. The problems of modelling of reactivity transients are described. An example of accident calculation is given. (author). 5 refs, 1 fig.

12945 (IAEA-TC—610, pp 46-58) **Technical report on the reactivity effects of nuclear fuel fragmentation with reference to the Chernobyl Accident.** Wasastjerna, F. (Technical Research Centre of Finland, Helsinki (Finland). Nuclear Engineering Lab.). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

This report describes a study which was carried out for presentation at the 30th NEACRP meeting (Helsinki 1987) in connection with Topic 1.4, reactivity effects of fuel fragmentation in light water reactors. The paper describes the reactivity effects caused by fragmentation of fuel with simultaneous cooling of the fragments. A series of LWR cases and three speculative scenarios for the Chernobyl accident are considered. Calculations were carried out with the LWR cell burnup code CASMO-HEX. Fragmentation is described by the increasing number of fuel pins with decreasing diameter and cooling is considered to occur as quasi-stationary. Relative movement of the fragments and the coolant is taken into account by varying the fuel/coolant ratio. Under certain circumstances substantial reactivity increases are found to occur. In particular, in RBMK reactors full homogenization of the fuel into the coolant with consequent cooling of the fuel and removal of most of the water and some of the fuel from the channels as a consequence of boiling may cause a reactivity increase of the order of 10 $. (author). 2 figs, 4 tabs.

12946 (IAEA-TC—610, pp 83-102) **Preliminary evaluation of the initiation phase of the Tschernobyl-Accident.** Frisch, W.; Langenbuch, S. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

A brief event description and a first preliminary evaluation of the initiation phase (up to the power excursion) is given on the basis of the information obtained during the Vienna meeting from August 25 to 28, 1986. The brief description of the event is based on chapter 2 through 4 of the Russian working document for the post accident review meeting, part 1, general material (English version) and on additional information obtained during the presentations and discussions of the meeting. The evaluation can only be preliminary and incomplete due to the lack of information on details of the design (e.g. control system, protection system, other safety systems) and a complete lack of information on test and operating procedures. Furthermore the evaluation of the transient behaviour of the Chernobyl plant is very difficult due to the lack of information on results of design calculations. 3 refs, 5 figs, 2 tabs.

12947 (IAEA-TC—610, pp 137-151) **Reactivity effects of water ingress in HTGRs. A review.** Szabo, J.; Greenspan, E.; Ketter, A.; Ron, S. (Israel Atomic Energy Commission, Tel Aviv). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

Accidents resulting in the entrance (ingress) of water into the primary circuit of an HTR are considered significant from a safety engineering point of view because there is the danger of several fission product barriers being affected simultaneously. Water reacts chemically with hot graphite corroding the fuel elements and producing burnable gases whose release may lead to explosive gas mixtures. Steam and the reaction products formed during water ingress will also cause a pressure build-up in the primary circuit. Furthermore, the addition of water to the HTR submoderated core will introduce a positive reactivity due to (1) the undermoderated design of the HTR and (2) the better moderation quality of the water over the helium. This report addresses the reactivity effect of water ingress in an attempt to determine whether a realistic threat to plant safety indeed exists or it can be ruled out, all this without employing sophisticated calculational tools. 13 refs, 11 figs, 1 tab.

12948 (IAEA-TC—610, pp 152-178) **Neutronics of the accident at Chernobyl.** Loizzo, P. (ENEA VEL, Casaccia (Italy)). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

Standard computation methods are used to make a preliminary analysis of the neutronic and thermohydraulic phenomena manifested during the first two phases of the accident at Chernobyl (positive reactivity generation and first Doppler transient). The most important phenomena discussed in this paper are as follows. In the accident configuration, the average void coefficient relating to the voiding of the entire core is assumed to be .03 (.3 mk/% voids). However, if only the regions nearest the core axis are voided, the void coefficient becomes three times as high. This fully explains the abnormal increase in reactivity which took place in the first phase of the transient. The design error in the scram rod (reduced length of the graphite follower) can cause a spurious introduction of positive reactivity when the rods are inserted to the first meter. This effect amounts to only about 1 mk (100 pcm or so) if all the other rods are withdrawn and becomes about 4 mk (400 pcm) if some of the regulating rods are inserted about one-third of the way. However, this does not appear to be the case. The Doppler effect is the only one introducing a negative feedback during the transient. However, this effect, too, is not very effective because the feedback is highly dependent on the surface temperature of the UO/sub 2/. At the melting point of the oxide, the effective temperature of the fuel barely amounts to 1700 deg. C. The model for calculating effective temperature needs to be re-analysed. The Soviet model for zero-dimensional kinetics, although somewhat rough, does take these phenomena into account but it is not reliable for calculating the final phase of the accident: disassembly of the core and generation of mechanical energy which caused the explosion (or explosions?). (Abstract Truncated)

12949 (IAEA-TC—610, pp 9-22) **Assessment of reactivity initiated accidents: Ontario Hydro experience.** Frescura, G.M. 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

12950 (IAEA-TC—610, pp 338-346) **Unprotected reactivity accidents in fast breeder reactors.** Wider, H.U. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

This paper gives a short overview on the different types of unprotected reactivity accidents which are considered in the safety analysis of Liquid Metal Fast Breeder Reactors (LMFBRs). It deals mostly with large oxide fuel reactors but some reference is made to the new small US metal fuel designs. 11 refs, 4 figs.

12951 (IAEA-TC—610, pp 23-45) **Transients analysis due to reactivity insertion in the RECH-2 reactor.** Klein, J. (Comision Chilena de Energia Nuclear, Santiago). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

This paper presents the results of some preliminary analyses of reactivity insertion in the RECH-2 reactor, where the core is configured with 30 fuel elements using 90% enriched uranium. The analysis has been made using the PARET code, where the insertion of the following ramps was considered: (1) 0.1 $/sec, and (2) 1.5 $/0.5 sec. It is supposed that the reactivity insertion rate occurs when the reactor has reached different power levels up to 2 MW. Other calculations were made in order to study the behaviour and sensibility of the code. (author). 6 refs, 12 figs, 12 tabs.

12952 (IAEA-TC—610, pp 219-255) **Analysis of the fast transients in the Polish research reactor MARIA.** Kubowski, J. (Institute of Atomic Energy, Otwock-Swierk (Poland)). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

The paper presents the analysis of the physical process in the Polish research reactor MARIA during fast reactivity excursions. With regard to some specific features of the reactor MARIA a short description of its core is given, followed by the dynamic and the core heat transfer models. On the basis of these models, the code TOTEM for the CYBER-73 digital computer was written in FORTRAN-EXTENDED. The code is intended for the analysis of reactor accidents caused by the rapidly increased reactivity. The code was verified experimentally. A comparison of the measured and calculated feedback reactivity and temperatures has shown good agreement. With the aid of the code the following hypothetical accidents in the research reactor MARIA have been analysed: (a) the loss-of-flow accident, (b) linear reactivity insertion with the constant ramp rate of 4 $/s, (c) linear reactivity insertion with the constant ramp rate of 10 $/s, including the shutdown reactivity. It follows from the analysis that all considered accidents do not endanger the safety of the reactor. (author). 8 refs, 14 figs.

12953 (IAEA-TC—610, pp 256-259) **Reactivity inducted transients in Swedish nuclear power plants - A regulatory perspective.** Mattson, J.; Sandervaag, O. 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705254/JAW. (CONF-8711178—).

From Meeting of the technical committee on safety matters lint to accidents caused by a reactivity transient; Vienna, Austria (17 Nov 1987).

The interest in reactivity inducted transients is mainly caused by the accident in Chernobyl-4. The Swedish Nuclear Power Inspectorate initiated a study to survey the state-of-the-art on reactivity transients which are relevant for Swedish reactors. One of the objectives was to identify gaps and limitations in the available information. An objective was also to review the regulatory practice on reactivity transients relative to fuel failure. 1 ref.

12954 **(INFO—0234) Accident at Chernobyl and its implications for the safety of CANDU reactors.** (Atomic Energy Control Board, Ottawa, Ontario (Canada)). May 1987. 104p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705266/JAW.

French translation included as INFO--0234F.

In August 1986, a delegation of Canadians, including two members of the staff of the AECB (Atomic Energy Control Board), attended a post-accident review meeting in Vienna, at which Soviet representatives described the accident and its causes and consequences. On the basis of the information presented at that meeting, AECB staff conducted a study of the accident to ascertain its implications for the safety of CANDU nuclear reactors and for the regulatory process in Canada. The conclusion of this review is that the accident at Chernobyl has not revealed any important new information which would have an effect on the safety requirements for CANDU reactors as presently applied by the AECB. All important aspects of the accident and its causes have been considered by the AECB in the licensing process for currently licensed reactors. However a number of recommendations are made with respect to aspects of reactor safety which should be re-examined in order to reinforce this conclusion.

12955 **(JAERI-M—88-151) Study on diffusion and natural circulation of two component gases. Experiment and analysis with a reversed U-shaped pipe.** Takeda, Tetsuaki; Hishida, Makoto. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 25p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756561/JAW.

When a primary coolant pipe of a High Temperature Gas Cooled Reactor (HTGR) ruptures, helium gas in the reactor core blows out into the container, and the primary coolant system re-

duces the pressure. After the reactor core and the container pressures are balanced, air is expected to ingress into the reactor core from a broken part by natural circulation and diffusion. It seems to be probable that the graphite structures is oxidized by the air. It is difficult to predict the air ingress rate, because complicated natural circulations take place in the reactor core, and diffusion paths are also complicated. In order to study the basic features of the air ingress during the early stage of the primary pipe rupture accident of the high temperature gas cooled reactor, the natural circulation of the two component gases was studied experimentally and analytically. The experiment was performed with a reversed U-shaped round pipe with one pipe heated and the other cooled. The analytical results were in good agreement with the experimental ones.

12956 **(JAERI-M—88-158) Current status of research on FBR fuel behavior under accident conditions and the relevant NSRR program plan.** Sobajima, Makoto; Fuketa, Toyoshi; Sasajima, Hideo; Yamazaki, Toshi; Kumamaru, Hiroshige; Nakamura, Takehiko; Fujishiro, Toshio. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 210p. (In Japanese). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88756564/JAW.

In the situation that the development of demonstration FBR is being materialized, a substantial research on safety of core fuels under accident conditions is required as the part of the research and development program. The experimental study of fuel integrity against over power accidents etc. and failure behavior is important to establish a criteria for safety evaluation of FBR's. In this report, the scope of the program which is planned in NSRR is shown after reviewing other related experiments and examining the research region left undone. Major in-core experiments on fuel failure are surveyed wide in the view point of experimental region and the inquired results are summarized. Subsequently, the items and methods due to the NSRR experiment program is discussed. The experimental facility plan and the results of preliminary analysis on the fuel energy deposition and temperature behavior are also introduced.

12957 **(JAERI-M—88-166) Effect of core inlet water flow rate on reflooding phenomena in the forced feed SCTF Core-I tests.** Ohnuki, Akira; Iwamura, Takamichi; Adachi, Hiromichi. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Sep 1988. 108p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756567/JAW.

The present report investigates the effects of core inlet water flow rate (Mi) on the reflooding phenomena in the core observed in the Slab Core Test Facility (SCTF) Core-I tests. The effects on the two-dimensional core thermal-hydraulic phenomena are emphasized. The following forced feed test results are examined : Tests S1-01 [Mi in Acc injection period = 16 kg/s (flooding velocity = 6.6 cm/s), Mi in LPCI injection period = 10 kg/s (4.1 cm/s)], S1-SH1 [29 (12.0), 10 (4.1)], S1-05 [16 (6.6), 6 (2.1)] and S1-09 [29 (12.0), 19 (7.8)]. Major conclusions derived from this study are as follows : (1) Larger core inlet flow rate gave larger water accumulation rate in the core and resultantly better core cooling. Larger core inlet flow rate gave larger water accumulation rate in the upper planum and larger water flow rate through the hot leg. (2) The two-dimensional thermal-hydraulic behaviors in the core (radial differences on void fraction and on heat transfer coefficient) were not significantly affected by the magnitude on the core inlet flow rate. (3) The dependency of heat transfer coefficients on the core inlet flow rate was qualitatively consistent with modified Murao-Sugimoto correlation which includes the correction factor of liquid flow rate. The correlation slightly underestimated the heat transfer coefficients quantitatively. The cause of the underestimation was discussed by evaluating the flow circulation in the core.

12958 **(JAERI-M—88-180) TRAC-PF1 assessment on direct-contact condensation in horizontal countercurrent stratified flow.** Lee, Won-Jae; Watanabe, Tadashi; Hirano, Masashi. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756577/JAW.

The condensation in countercurrent stratified two-phase flow is one of the important phenomena for safety analyses of nuclear reactors. The physical benchmark problem on the direct-contact condensation under the horizontal countercurrent stratified flow was analysed using the TRAC-PF1 one-dimensional model. The experimental data provided in the problem was obtained by observing flow conditions in the rectangular test section which had inlets for superheated steam at one end and subcooled water at the other end. The heat transfer model of TRAC-PF1 depends on the liquid-side condition, and the condensation rate was overpredicted though the interfacial heat transfer area was underpredicted. The interfacial area therefore was fixed to be the same as the area of test section and the Kim's empirical correlation was implemented to the code. Power coefficients were modified so as to obtain the good agreement between experimental and calculated results. The capability of TRAC-PF1 in predicting the condensation rate under the horizontal countercurrent stratified flow was enhanced due to the modification.

12959 **(NKA-AKTU—245(87)1) Dry deposition on smooth and rough urban surfaces.** Roed, J. (Risoe National Lab., Roskilde (Denmark)). Jan 1987. 10p. (CONF-8702167—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756202/JAW.

From The Post-Chernobyl workshop; Brussels, Belgium (3 Feb 1987).

Following the Chernobyl accident, dry deposition velocities on smooth surfaces indoors and outdoors have been measured in Denmark. Internal wall surfaces gave deposition velocities of 0.0008-0.0009 cm/s for 131I and 0.0001-0.0002 cm/s for 134Cs and 103Ru. Internal floor surfaces gave higher values for the deposition velocities: for 131I, 0.002 cm/s and for 134Cs and 103Ru, 0.0005-0.0013 cm/s. The deposition velocities on vertical and horizontal external surfaces were nearly equal. Those for 131I were found as 0.02-0.03 cm/s and for 137Cs as 0.001-0.002 cm/s. On external rough surfaces such as grass and corrugated roof material the deposition velocities for 134Cs and 103Ru were 0.03-0.05 cm/s. For iodine, however, deposition velocities were higher for clipped grass (2 cm/s) than for roof material (0.2-0.4 cm/s). The results show that internal deposition velocities are considerably lower than those on external smooth surfaces, and that the deposition velocities on rough surfaces are an order of magnitude higher than on smooth surfaces. It was also shown that the deposition velocities of iodine are considerably higher than those of cesium and ruthenium. This work was supported by EEC Radiation Protection Programme No B16-107-DK and by NKA, The Nordic Liaison Committee for Atomic Energy.

12960 **(NUREG—0090-Vol.11-No.2) Report to Congress on abnormal occurrences, April--June 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Dec 1988. 33p. NTIS, PC A03/MF A01 - GPO - OSTI. Order Number TI89005928/JAW.

Section 208 of the Energy Reorganization Act of 1974 identifies an abnormal occurrence as an unscheduled incident or event which the Nuclear Regulatory Commission determines to be significant from the standpoint of public health or safety and requires a quarterly report of such events to be made to Congress. This report covers the period from April 1 to June 30, 1988. For this reporting period, there were no abnormal occurrences at nuclear power plants licensed to operate. There were two abnormal occurrences at other NRC licensees: a significant breakdown in management and procedural controls at a medical facility and a medical diagnostic misadministration. There was one abnormal occurrence reported by an Agreement State (Texas) involving radioactive material released during a transportation accident. The report also contains information updating some previously reported abnormal occurrences.

12961 **(NUREG/CR—5074) Development of a phenomena identification and ranking table (PIRT) for thermal-hydraulic phenomena during a PWR [pressurized water reactor] large-break LOCA [loss-of-coolant accident].** Shaw, R.A.; Rouhani, S.Z.; Larson, T.K.; Dimenna, R.A. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1988. Contract AC07-76ID01570. 99p. (EGG—2527). NTIS, PC A05 - GPO - OSTI. Order Number TI89004444/JAW.

The US Nuclear Regulatory Commission (NRC) is proposing to amend its regulations to permit the use of best-estimate safety analysis codes to demonstrate that the emergency core cooling system would protect the reactor core during a postulated loss-of-coolant accident (LOCA). A key feature of this proposed rule is that the licensee will be required to quantify the uncertainty of the best-estimate calculations and include that uncertainty when comparing the calculated results with the Appendix K limits. The NRC has further proposed a Code Scaling, Applicability, and Uncertainty (CSAU) evaluation methodology. One of the cornerstones of that methodology is the identification and ranking of all the processes that occur during a specific scenario. The ranking is done according to importance during the scenario and is used to limit the uncertainty analysis to a sufficient, but cost effective scope. The work reported in this document identifies the thermal-hydraulic phenomena that occur during a large-break loss-of-coolant accident (LBLOCA) in a Westinghouse four-loop pressurized water reactor and ranks the relative importance of each with respect to peak cladding temperature. 14 refs., 47 figs., 6 tabs.

12962 **(NUREG/CR—5173) Review and assessment of thermodynamic and transport properties for the CONTAIN Code.** Valdez, G.D. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Sandia National Labs., Albuquerque, NM (USA)). Dec 1988. Contract AC04-76DP00789. 163p. (SAND—88-7101). NTIS, PC A08/MF A01 - GPO - OSTI. Order Number TI89005364/JAW.

A study was carried out to review available data and correlations on the thermodynamic and transport properties of materials applicable to the CONTAIN computer code. CONTAIN is the NRC's best-estimate, mechanistic computer code for modeling containment response to a severe accident. Where appropriate, recommendations have been made for suitable approximations for material properties of interests. Based on a modified Benedict-Webb-Rubin (BWR) equation of state, a procedure is introduced for calculating thermodynamic properties for common gases in the CONTAIN code. These gases are nitrogen, oxygen, hydrogen, carbon dioxide, carbon monoxide, steam, helium, and argon. The thermodynamic equations for density, currently represented in CONTAIN by relatively simple fits, were independently checked and are recommended to be replaced by the Lee-Kesler equation of state which substantially improves accuracy without too much sacrifice in computational efficiency. The accuracy of the calculated values have been found to be generally acceptable. Various correlations and models for single component gas transport properties, viscosity and thermal conductivity, were also assessed with available experimental data. When a suitable correlation or model was not available, transport properties were obtained by performing least-squares fit on experimental data. 50 refs., 126 figs., 3 tabs.

12963 **(NUREG/CR—5191) Closeout of IE Bulletin 80-17: Failure of 76 of 185 control rods to fully insert during a scram at a BWR [boiling water reactor].** Dean, R.S.; Foley, W.J.; Hennick, A. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Operational Events Assessment; Parameter, Inc., Elm Grove, WI (USA)). Dec 1988. 41p. NTIS, PC A03/MF A01 - GPO - OSTI. Order Number TI89005613/JAW.

Documentation is provided in this report for the closeout of IE Bulletin 80-17 on the subject of safety-related failures of control rods to insert fully at boiling water reactors (BWRs). Closeout is based on the implementation and verification of numerous actions required for compliance with the initial bulletin and five supplements. Evaluation of utility responses and NRC/region inspection reports indicates that the bulletin is closed for all of the 23 operating BWRs to which it was issued for action. The main reason for incomplete insertion of control rods was found to be retention of a significant amount of undetected water in the scram discharge volume (SDV). The bulletin and its supplements were forwarded for information only to all BWRs with a construction permit. 2 tabs.

12964 **(SKI—87089) RELAP 5 Simulations of a hypothetical LOCA in Ringhals 2.** Caraher, D. (Swedish Nuclear Power Inspectorate, Stockholm; Studsvik Energiteknik AB, Nykoeping (Sweden)). 18 Sep 1987. 71p. (STUDSVIK-NP—87-105). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756206/JAW.

RELAP5 simulations of a hypothetical LOCA in Ringhals 2 were conducted in order to determine the sensitivity of the calculated peak cladding temperature (PCT) to Appendix K requirements. The PCT was most sensitive to the assumed model decay heat: Changing from the 1979 ANS Standard to 1.2 times the 1973 Standard increased the PCT by 70 to 100K. After decay heat, the two parameters which affected the PCT the most were steam generator heat transfer and heat transfer lockout. The PCT was not sensitive to the assumed pump rotor condition (locked vs coasting); nor was it sensitive to a modest amount (5 to 10%) of steam generator tube plugging.

12965 **(SSI—88-02) Diet customs in relation to Chernobylsk. Interviews by Statistics Sweden.** Elvers, E.; Falk, R.; Holmberg, M. (Statistics Sweden, Stockholm (SE); National Inst. of Radiation Protection, Stockholm (Sweden)). (National Inst. of Radiation Protection, Stockholm (Sweden)). 15 Jan 1988. 14p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756207/JAW.

A random selection of 1000 people all over the country was interviewed in February 1987. The interview was directed towards foodstuffs important from radiation protection point of view. The diet inquiry comprised milk products (quantity), reindeer meat, game, lake fish, some berries amd mushrooms (how often and where from) and finally whether diet customs have been changed because of the Chernobylsk accident. It appears i.a. that 10% of the Swedish population changed their diet customs because of the accident. (O.S.).

12966 (UTNL-R—212, pp 64-72) **Implications of inherent safe nuclear power system.** Song, Yo-Taik. (USDOE Assistant Secretary for Environment, Safety and Health, Washington, DC. Office of Nuclear Safety). Nov 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780050/JAW. (CONF-8709395—).

From Adhoc nuclear workshop: nuclear electric power base in the Asia-Pacific; Tokyo, Japan (4 Sep 1987).

The safety of present day nuclear power reactors and research reactors depends on a combination of design features of passive and active systems, and the alert judgement of their operators. A few inherently safe designs of nuclear reactors for power plants are currently under development. In these designs, the passive systems are emphasized, and the active systems are minimized. Also efforts are made to eliminate the potential for human failures that initiate the series of accidents. If a major system fails in these designs, the core is flooded automatically with coolants that flow by gravity, not by mechanical pumps or electromagnetic actuators. Depending on the choice of the coolants--water, liquid metal and helium gas--there are three principal types of inherently safe reactors. In this paper, these inherently safe reactor designs are reviewed and their implications are discussed. Further, future perspectives of their acceptance by nuclear industries are discussed.

12967 (UTNL-R—212, pp 90-97) **Note on the basic assumptions underlying design of PIUS type reactors.** Hannerz, K. (ASEA-ATOM AB, Vaesteraas (Sweden)). Nov 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780050/JAW. (CONF-8709395—).

From Adhoc nuclear workshop: nuclear electric power base in the Asia-Pacific; Tokyo, Japan (4 Sep 1987).

The purpose of the note is to point out that a revival of the nuclear option and its full use in the future require two things: a

rebuilding of public confidence, particularly with regard to reactor safety, that must start now; and long term, large scale operation, worldwide, without serious (core degradation) accidents. To make this possible, a new approach to reactor safety is needed. The protection against core degradation accidents must be a built-in property of the primary heat extraction process itself and not dependent on devices and systems that could fail to function or be tampered with (mistakenly or maliciously) by fallible humans. The PIUS designs make possible the realization of this goal. They differ from other LWR designs presently touted as 'inherently safe' in that core protection is based only on the forces of gravity and thermohydraulics acting on the primary coolant and not on the function of valves, control rods, etc. Extensive studies indicate that PIUS plants will be competitive, costwise, with present type LWRs since the drastic design simplification made possible by the built-in safety pays for the features that provide the latter, in particular the massive concrete vessel. (Nogami, K.).

12968 **(WHC-SA—0300-Rev.1) Some safety considerations for steam coolant with liquid metal breeders.** Jeppson, D.W. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1988. Contract AC06-87RL10930. 7p. (CONF-881031—26-Rev.1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003914/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

Test results indicate the rate and quantity of hydrogen generation, aerosol characterization and release rates, radioactive species behavior, and potential attack on blanket candidate metals for postulated fusion reactor accident conditions when steam may be used near lithium breeder material. These results can be used to evaluate specific reactor safety concerns and to develop computer code models to predict consequences of postulated accidents involving steam and lithium. 7 figs., 4 tabs.

12969 **(WHC-SA—0443) Evaluation of Nuclear Facility Decommissioning Projects (ENFDP): Program status.** Haffner, D.R. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1988. Contract AC06-87RL10930. 11p. (CONF-8810155—30). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004901/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

The Evaluation of Nuclear Facility Decommissioning Projects (ENFDP) program was undertaken by the US Nuclear Regulatory Commission (NRC) to compile and evaluate the activities of completed and ongoing decommissioning projects. This report discusses briefly, the status of those decommissioning projects selected for this study with emphasis on ongoing projects.

12970 **Automatic safety rod for reactors.** Gerner, J.H. (to Dept. of Energy, Washington, DC). US Patent 4,769,208. 6 Sep 1988. Filed date 23 Mar 1982. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an automatic safety rod for use in a nuclear reactor cooled by a flow of fluid therethrough comprising: a casing provided with at least one opening in opposite ends, means containing neutron absorbing material located in the casing, seal means operatively connected to the means containing neutron absorbing material and constructed to be responsive to differential pressure thereacross and to substantially prevent a flow of fluid through one of the openings in the casing under normal fluid flow conditions, and pressure regulating means operatively positioned so as to be in fluid communication with the interior and the exterior of the casing for controlling differential pressure across the seal means. The pressure regulating means for preventing rapid response of the pressure regulating means except under conditions of sudden decrease of flow of fluid through the casing, the pressure regulating means being located within a handle assembly operatively connected to the means containing neutron absorbing material.

25 ENERGY STORAGE

REFER ALSO TO CITATION(S) 13018

2506 Thermal

REFER ALSO TO CITATION(S) 13041

12971 **(EPRI-EM—6144-Vol.1) Pilot test of the crushed-rock storage furnace: Volume 1, Summary of findings: Final report.** Ferraro, V.D.; Gibson, G.L.; Ishii, R.K. (Electric Power Research Inst., Palo Alto, CA (USA); Science Applications International Corp., San Diego, CA (USA)). Jan 1989. 116p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005738/JAW.

During the 1985-86 and 1986-87 heating seasons, the Electric Power Research Institute (EPRI) sponsored a pilot test of fifteen crushed rock heat storage furnaces which were manufactured by FluiDyne Engineering Corporation. Previous EPRI research established that low cost common rock (basalt) found throughout the United States performs well in heat storage furnaces and offers an excellent opportunity to reduce system costs which are a major obstacle to market acceptance of heat storage furnaces. The objective of the pilot test was to evaluate the technical merit of the crushed rock furnace in the field and to familiarize electric utilities and the general public with the new technology. The fifteen furnaces were installed and tested by seven utilities: Boston Edison, New England Electric Service, Northern States Power, Pennsylvania Power and Light, Public Service Electric and Gas, Tennessee Valley Authority, and United Power Association. A standard data acquisition system was installed at each test site to collect furnace performance data. Science Applications International Corporation monitored the testing, collected test data from the utilities, processed and analyzed the furnace performance data. This report documents the findings of the two year pilot test. 8 refs., 37 figs., 12 tabs.

12972 **(EPRI-EM—6144-Vol.2) Pilot test of the crushed-rock storage furnace: Volume 2, Appendixes: Final report.** Ferraro, V.D.; Gibson, G.L.; Ishii, R.K. (Electric Power Research Inst., Palo Alto, CA (USA); Science Applications International Corp., San Diego, CA (USA)). Jan 1989. 252p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005739/JAW.

During the 1985-86 and 1986-87 heating seasons, the Electric Power Research Institute (EPRI) sponsored a pilot test of fifteen crushed rock heat storage furnaces which were manufactured by FluiDyne Engineering Corporation. Previous EPRI research established that low cost common rock (basalt) found throughout the United States performs well in heat storage furnaces and offers an excellent opportunity to reduce system costs which are a major obstacle to market acceptance of heat storage furnaces. The objective of the pilot test was to evaluate the technical merit of the crushed rock furnace in the field and to familiarize electric utilities and the general public with the new technology. The fifteen furnaces were installed and tested by seven utilities: Boston Edison, New England Electric Service, Northern States Power, Pennsylvania Power and Light, Public Service Electric and Gas, Tennessee Valley Authority, and United Power Association. A standard data acquisition system was installed at each test site to collect furnace performance data. Science Applications International Corporation monitored the testing, collected test data from the utilities, processed and analyzed the furnace performance data. This document presents the data of the two year pilot test, and forms the appendices for the main body of the report which is provided in a separate document.

12973 **(PNL—6588) Potential energy savings from aquifer thermal energy storage.** Anderson, M.R.; Weijo, R.O. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 48p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006193/JAW.

Pacific Northwest Laboratory researchers developed an aggregate-level model to estimate the short- and long-term potential energy savings from using aquifer thermal storage (ATES) in the United States. The objectives of this effort were to (1) develop a

basis from which to recommend whether heat or chill ATES should receive future research focus and (2) determine which market sector (residential, commercial, or industrial) offers the largest potential energy savings from ATES. Information was collected on the proportion of US land area suitable for ATES applications. The economic feasibility of ATES applications was then evaluated. The potential energy savings from ATES applications was calculated. Characteristic energy use in the residential, commercial, and industrial sectors was examined, as was the relationship between waste heat production and consumption by industrial end-users. These analyses provided the basis for two main conclusions: heat ATES applications offer higher potential for energy savings than do chill ATES applications; and the industrial sector can achieve the highest potential energy savings for the large consumption markets. Based on these findings, it is recommended that future ATES research and development efforts be directed toward heat ATES applications in the industrial sector. 11 refs., 6 figs., 9 tabs.

2509 Batteries

REFER ALSO TO CITATION(S) 12503, 13054, 13081

12974 (AD-A—199698/2/XAB) Electrochemistry of carbon relative to batteries and fuel cells. Technical report. Yeager, E.; Tryk, D. (Case Western Reserve Univ., Cleveland, OH (USA)). 1 Sep 1988. 17p. (TR—65). NTIS, PC A03/MF A01.

Carbon of various types are extensively used in battery and fuel-cell applications as electronic conductors, a catalyst for specific reactions, a support for other catalysts, and as a high-surface-area electrode affording a large total capacity (capacitor batteries). This report considers the basic properties of carbons and graphites of importance to these applications including the electronic and solid state properties; pore structure of activated carbons; intrinsic surface electronic and electrochemical properties; surface-chemical groups and acid/base properties; redox reactions on carbon/graphite surfaces; electrocatalytic properties of carbon surfaces for various electrode reactions; Chemically modified carbon/graphite surfaces; electrochemical oxidation of carbon in battery and fuel cell applications.

12975 (PB—89-852750/XAB) Nickel-cadmium batteries. January 1977-December 1988 (Citations from the NTIS data base). Report for January 1977-December 1988. (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 134p. NTIS PC N01/MF N01.

Supersedes PB—88-855200.

This bibliography contains citations concerning the design, fabrication, testing, and applications of nickel-cadmium batteries. Considerable attention is given to the evaluation and development of these batteries for aircraft and spacecraft environments. (This updated bibliography contains 234 citations, 26 of which are new entries to the previous edition.)

12976 (SAND—88-2873C) Metal sulfide for battery applications. Guidotti, R.A. (Sandia National Labs., Albuquerque, NM (USA)). [1988]. Contract AC04-76DP00789. 18p. (CONF-890209—1). NTIS, PC A03/MF A01 - OSTI; GPO Dep. Order Number DE89005923/JAW.

From 92. national western mining conference and exhibition; Denver, CO, USA (8 Feb 1989).

A number of metal sulfides can be used in batteries as a cathode (reducible) material as part of an electrochemical couple to provide energy. There are a number of physical and chemical characteristics that can be evaluated for screening potential candidates for use in batteries. These include: cell potential vs. Li, thermal and chemical stability, electrical conductivity, allotropic form (phase), reaction kinetics during discharge, type of discharge mechanism, and material rechargeability. These are reviewed in general, with emphasis on sulfides of copper, iron, and molybdenum which are currently being used as cathodes in Li and Li-alloy batteries. The presence of impurities can adversely impact performance when naturally occurring sulfide minerals are used for battery applications. Sandia National Laboratories uses natural pyrite (FeS_2) for its high-temperature, thermally activated Li(Si)/FeS_2 batteries. The purification and processing procedures for the FeS_2 involves both chemical and physical methods. Flotation was found to yield comparable results as HF leaching for removal of silica, but without the negative health and environmental concerns associated with this technique. 11 refs., 5 figs., 6 tabs.

29 ENERGY PLANNING AND POLICY

REFER ALSO TO CITATION(S) 13018

2901 Energy Analysis And Modeling

12977 (ESC-WR—88-33) Structure and use of the electric power model LEMS. Boonekamp, P.G. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Dec 1988. 56p. (In Dutch). Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

The Dutch energy model SELPE has been developed to analyse possible developments in energy supply and demand in the future. In order to be able to predict substitutions of energy sources and energy conversion processes all relevant energy sources, energy consumer sectors, and energy conversion processes are described together with its energy, environment, and cost implications. The supply sectors (energy sources) are: (natural) gas, petroleum, coal, and electric power. Over the years the electric power sector has become more important especially with respect to investments which have to be made for periods longer than envisaged in SELPE. A separate model, called LEMS, has been developed for the electric power sector. This report describes the modular structure of LEMS and how it works. 8 figs., 14 refs., 2 tabs.

12978 (ESC-WR—88-34) Discrete choice analyses for the purpose of market studies on energy technologies. Bais, J.M. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Dec 1988. 104p. (In Dutch). Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

The study as stated in the title is aimed at developing a method to determine the penetration of energy technologies. Next to financial-economical criterions also other aspects (socio-demographical-, product-, industrial characteristics) are taken into account with regard to the market penetration calculations. The developed method of investigation is based on Discrete Choice Analyses and Logit models and deals with financial-economical as well as psychological aspects of the decision-making process with regard to energy saving technologies. First the selection process to invest in energy technologies and some market research aspects are dealt with. Subsequently the structure of the method is discussed: present method to determine potentials; method structure according to Market Penetration Studies; choice investigation by means of Discrete Choice Analyses; Logit-analysis; determination of market shares and estimation of penetration. The appendices present results of the estimated penetration calculations and discuss the Logit models. 11 figs., 20 refs., 3 tabs., 2 app.

12979 (ESC-WR—88-35) The long term evaluation module of the Dutch electric power model LEMS. Verhagen, L. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Dec 1988. 30p. (In Dutch). Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

The Dutch energy model SELPE has been developed to analyse possible developments in energy supply and demand in the future. In order to be able to predict substitutions of energy sources and energy conversion processes all relevant energy sources, energy consumer sectors, and energy conversion processes are described together with its energy, environment, and cost implications. A separate model, called LEMS, has been developed for the electric power sector. The central submodel of LEMS is the long term evaluation module LTE which is able to evaluate supply and demand of electric power over a long planning period (more than 25 years). The module LTE contains the data which are used in the four modules of LEMS. This report describes the structure of the LTE module and how it works. 2 figs.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 12603, 12664, 12978, 13051, 13317, 13616, 14070

12980 (AD-A—199888/9/XAB) Soviet political objectives in the Federal Republic of Germany: instruments and assessments. Master's thesis. Goebel, S.E. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1988. 104p. NTIS, PC A06/MF A01.

This thesis examines apparent Soviet attempts to use its detente policy to exploit the Federal Republic of Germany's membership in NATO and thereby expand its influence in the FRG and Europe as a whole. It is hypothesized that the Soviet Union chooses to exploit the FRG's position in NATO by cultivating a special relationship with it and thereby accessing the U.S. and NATO as a whole, rather than making overt efforts to force a near-term split between West Germany and the U.S. The thesis focuses on the instruments the Soviet Union uses to maximize its influence in the FRG and the region. These instruments include West Germany's concerns regarding nuclear war in Europe, Ostpolitik and German-German relations.

12981 (DOE/EI/20476—T1) Pennsylvania 1987/88 State Heating Oil Program. (Pennsylvania Energy Office, Harrisburg (USA)). 29 Jun 1988. Contract FC01-87EI20476. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005903/JAW.

The Pennsylvania Energy Office, Bureau of Fossil Fuels, participated in the 1987/88 State Heating oil Program under a cooperative agreement with the US Department of Energy, Energy Information Administration (DOE/EIA). From October through May, participating dealers and distributors were surveyed for their current retail and wholesale prices of No. 2 home heating oil. Primary inventory data was also collected from select bulk terminals and refiners. This report summarizes information on Pennsylvania's home heating oil prices and inventories during the 1987/88 heating season.

12982 (EPRI-EM—6133) Status of least-cost planning in the United States: Final report. Chamberlin, J.; Fry, T.; Braithwait, C.L.M. (Electric Power Research Inst., Palo Alto, CA (USA); Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA)). Dec 1988. 62p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005313/JAW.

The purpose of this report is to cover least-costing planning adoption state by state and to provide some insight into the motivations and implications for its implementation. Summary maps graphically display general adoption trends. Data tables and graphs of key economic factors provide a basis for cross-sectional analysis of least-cost planning development. 11 refs.

12983 (PB—89-116610/XAB) Investigation into the establishment of a corporation for energy financing. Final report. Klepper, M.; Michaelson, M.L. (Lane and Edson, P.C., Washington, DC (USA)). Aug 1987. 124p. NTIS, PC A06/MF A01.

Performance contracting addresses one of the most significant barriers to energy projects, which historically has been the lack of funding. However, there are barriers to the use of performance contracting in New York. Lack of information on the part of building managers and financial institutions, a need for ongoing, intensive technical assistance to users, complex procurement procedures and regulations, and the number of small projects with high transaction costs are all reasons why performance contracting has not been used to a greater extent in New York and elsewhere. The creation of two new organizations, one within New York State government, and one a private, nonprofit organization, could address several of these barriers. The Office for Energy Financing could be created as a pilot program within the Energy Authority to offer information, brokering, pooling, and project-management services. Over time, the Office should be able to reduce market barriers and transaction costs that limit private investment in energy projects. This organization would raise and distribute funds by tapping both public and private sources of investment capital.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 12649, 12685, 12816, 12817, 12891, 12893, 13042, 13063, 13064, 13066, 13067, 13068, 13069, 13070, 13084, 13089, 13306, 13307, 13313, 13476, 13537, 13538, 13539, 13540, 13541, 13542, 13557, 13558, 13559, 13585, 13597, 13598, 13599, 13600, 13601, 13602, 13603, 13659, 13660, 13661, 13662, 13663, 13664, 13665, 13701, 14074, 14076

12984 (AD-A—200435/6/XAB) Conceptual basis for a hazardous-waste component of the Army Eenvironmental Data Management System (AEDMS). Final report. Kim, B.J.; Gee, C.S.; Marlatt, R.M.; Canete, D.; Pluckhorn, E. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Sep 1988. 116p. (CERL-TR-N—88/23). NTIS, PC A06/MF A01.

The increasing awareness of environmental contamination and threats to human health from hazardous waste has prompted Congress to pass comprehensive legislation that calls for rigorous management of hazardous-waste activities. To assist the Army in complying with the reporting requirements of numerous regulations, the U.S. Army Construction Engineering Research Laboratory (USA-CERL) compiled and analyzed the Federal, State, Department of Defense, and Army hazardous waste regulations. This analysis defined the hazardous-waste data already available to Army environmental personnel. The analysis also defined the additional information needed to improve the Army hazardous-waste management programs. The results were then used to develop the concept for a hazardous waste component for the Army Environmental Data Management System (AEDMS).

12985 (PB—89-126320/XAB) Hazardous-waste enforcement in Illinois, Fiscal year 1987. Report for 1 July 1986-30 June 1987. Svoboda, J.; Muraro, J. (Illinois Environmental Protection Agency, Springfield (USA). Enforcement Programs). Oct 1988. 87p. (IEPA/ENF—88-037). NTIS, PC A05/MF A01.

See also report for 1986, PB—88-150032. Portions of this document are not fully legible.

A brief overview is presented of enforcement policies and procedures by the Illinois Environmental Protection Agency, particularly as they involve violations concerning hazardous wastes or materials, and the various enforcement options available to IEPA to secure compliance.

12986 (PB—89-126338/XAB) Cleaning Illinois: status of the state's hazardous-waste cleanup programs, Spring 1988. Report for 1970-1988. Muraro, J. (Illinois Environmental Protection Agency, Springfield (USA). Div. of Land Pollution Control). Jun 1988. 52p. (IEPA/GCA—88/027). NTIS, PC A04/MF A01.

See also report for 1986, PB—87-113809.

This is an updated version of an earlier (1986) report, which outlines the current status of Illinois efforts to deal with cleaning up hazardous-waste sites, including those on the NPL, the SRAPL, voluntary cleanups, and immediate removals.

12987 (PNL—6669) Secondary economic impact of acid deposition control legislation in six coal producing states: Final report. Scott, M.J.; Guthrie, S.J. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 65p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005487/JAW.

Among the difficult policy questions on the US environmental agenda is what to do about emissions to the earth's atmosphere of pollutants that may result in "acid rain". The Congress has considered several pieces of legislation spelling out potential approaches to the problem and setting goals for emission reduction, mostly emphasizing the control of oxides of sulfur and nitrogen. Significant policy concern is the dollar costs to the nation's economy of achieving the intended effects of the legislation and the potential impacts on economic activity---in particular, losses of both coal mining and secondary service sector employment in states and regions dependent on the mining of high sulfur coal. There are several direct economic effects of regulations such as the acid rain control legislation. One of the more obvious effects was the switching from high sulfur coal to low sulfur coal. This would result in in-

creases in employment and coal business procurements in low sulfur coal mining regions, but also would result in lower employment and lower coal business procurements in high sulfur coal mining areas. The potential negative effects are the immediate policy concern and are the focus of this report. 15 refs., 1 fig., 17 tabs.

12988 **The hazardous waste remedial actions program.** Petty, J.L.; Sharples, F.E. (Hazardous Waste Remedial Actions Program, Support Contractor Office, Oak Ridge National Lab., Oak Ridge, TN (US));. pp v of Proceedings of the fourth annual hazardous materials management conference. Wheaton, IL; Tower Conf. Management Company (1986). (CONF-860695—).

From HazMat '86: hazardous materials management conference and exhibition; Atlantic City, NJ, USA (2 Jun 1986).

The Hazardous Waste Remedial Actions Program (HAZWRAP) was recently established by the Department of Energy's (DOE) Assistant Secretary for Defense Programs (ASDP). The goal of HAZWRAP is to serve as a focal point and integrate Defense Programs' (DP's) responses to the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA). The major near-term objectives of HAZWRAP are to: Provide technical support in the identification and correction of CERCLA- and RCRA-related deficiencies at DP field sites. Plan and recommend alternatives for implementing a structured remedial action program to ensure that DP sites achieve compliance with applicable regulatory requirements of hazardous and mixed wastes while protecting public health and safety and the environment. Conduct budgetary management and analysis, integrated scheduling and planning, and technology demonstration to support long-term cost-effective remedial action activities. Provide an information system to facilitate DP-wide communication and dissemination of hazardous waste information and technology. Coordinate activities with other DOE offices, such as the Office of the Assistant Secretary for Environment, Safety and Health, to ensure that DP's remedial actions conform to overall Departmental policy on environmental compliance and management.

12989 **DOE waste information network.** Fore, C.S. (DOE Hazardous Waste Remedial Actions Program, HAZWRAP Support Contractor Office, Oak Ridge National Lab., Oak Ridge, TN (US));. pp v of Proceedings of the fourth annual hazardous materials management conference. Wheaton, IL; Tower Conf. Management Company (1986). (CONF-860695—).

From HazMat '86: hazardous materials management conference and exhibition; Atlantic City, NJ, USA (2 Jun 1986).

The Hazardous Waste Remedial Actions Program (HAZWRAP) was established by the U.S. Department of Energy's (DOE) Office of ASDP to support the improvement of hazardous chemical and radioactive mixed waste management for DOE Defense Programs (DP), such that public health and safety are protected and DP missions are efficiently accomplished. A major component of the program involves the development of specialized information systems encompassing all aspects of hazardous chemical and mixed radioactive waste technology. This effort is structured into three key areas. The first and second areas focus on the formulation of a variety of computerized data bases designed for information retrieval and evaluation and the analysis of the collected data. The third area involves the development of several information transfer mechanisms that will provide a means for promoting hazardous waste information exchange between all DOE installation. Collectively, these three subtasks are combined to formulate the Waste Information Network (WIN).

2904 Natural Resources

REFER ALSO TO CITATION(S) 12789, 13595

12990 **(ORNL—6256) Issues and options for achieving national security in the United States during national emergencies: Phase 1, A pilot study of grain stocks and stocks at risk.** Kerley, C.R.; Das, S. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 84p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005702/JAW.

This study examines issues associated with using unprocessed grain stocks as a post-disaster food resource in national emergencies. Federal Emergency Management Agency (FEMA) data on locations at high risk for nuclear attack are combined with agricultural statistics from the United States Department of Agriculture (USDA) to identify high-risk grain stocks and the proximity of people to stored stocks. Seasonal fluctuations in stocks between 1981 and 1985 indicate that days of nutrition from stored grains have ranged from a low of 600 days to a high of 1800 days. In 1984 about 40% of government-owned grain stocks were stored in high-risk counties. If transportation services were lost in a national disaster, 57% of the US population would have access to only 8% of the unprocessed stored grains and 2% of government-owned stocks. A transportation model is used to calculate the ton-mile movements and transport costs of relocating grains to achieve 30 days and 60 days of nutrition in all States from stored grain stocks. The most feasible options for achieving national food security in the US include food relocation action plans and cooperative efforts with USDA to reduce risk to government-owned food stocks. 8 figs., 9 tabs.

12991 **(PB—89-124234/XAB) Mineral resources of the Cedar Mountain Wilderness Study Area, Washakie and Hot Springs Counties, Wyoming.** Larsen, C.E.; Hill, R.H.; Kulik, D.M.; Brown, M.K.; Scott, D.C. (Geological Survey, Alexandria, VA (USA)). 15 Jul 1988. 30p. (USGS-BULL—1756-B). NTIS, PC A03/MF A01.

Also available from Supt. of Docs. Library of Congress catalog card no. 88-600336. Color illustrations reproduced in black and white.

The Cedar Mountain Wilderness Study Area (WY-010-222) consists of approximately 21,570 acres along the east bank of the Bighorn River, east of the town of Kirby, WY. Field studies were made to appraise the identified (known) resources and assess the mineral resource potential (undiscovered) of the study area. No mines or prospects are located within the study area, and it has no identified resources. However, coal was mined within the Upper Cretaceous Mesaverde Formation 2 miles south of the area. The resource potential for coal is low in the southernmost part of the study area; the remainder of the area has no potential for coal resources. Anomalous gold concentrations identified in three stream-sediment samples indicate a moderate potential for gold resources. An extension of a known oil- and gas-producing structure, the Neiber anticline, crosses the northeastern part of the area, and another producing structure is 4 miles southwest of Cedar Mountain. Based on the proximity of these structures, inferred faulting beneath the central part of the area, and oil and gas shows in dry wells drilled within the area, the potential for oil and gas resources is considered moderate for two areas in the north and central parts of the study area, and low for the remainder of the area.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 12981, 13023, 13024, 13317, 13616

12992 **(DOE/ER—0394) Technology '88: Annual report.** (USDOE, Washington, DC). Dec 1988. 159p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89001600/JAW.

An overview of technology transfer of US Department of Energy's National Laboratories is presented. Areas specifically presented are: Materials Science and Manufacturing; Processes Analy-

sis and Instrumentation; Energy Technology; Environment and Waste Management; Biology and Medicine; and Computers and Communication. Specific research accomplishments are discussed. (CBS)

12993 **(DOE/ER—0401) Summaries of FY 1988 engineering research.** (USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences). 1988. 56p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006393/JAW.

This report documents the BES Engineering Research program for fiscal year 1988; it provides a summary for each of the program projects in addition to a brief program overview. The report is intended to provide staff of Congressional committees, other executive departments, and other DOE offices with substantive program information so as to facilitate governmental overview and coordination of Federal research programs. Of equal importance, its availability facilitates communication of program information to interested research engineers and scientists. The organizational chart for the DOE Office of Energy Research (OER) on the next page delineates the six Divisions within the OER Office of Basic Energy Sciences BES Division administers basic, mission oriented research programs in the area indicated by its title. The BES Engineering Research program is one such program; it is administered by the Engineering and Geosciences Division of BES.

12994 **(MLM—3555) Technology Update-88.** Fitzharris, P.A. (ed.). (EG and G Mound Applied Technologies, Miamisburg, OH (USA)). Dec 1988. Contract AC04-88DP43495. 27p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006562/JAW.

This, December 1988, Mound Laboratories Technology Update contains: modifying surfaces with plasma; cost-effective process control; destructive testing at the new explosive component test facility; tailoring of explosive powders; and paperless manufacturing systems. (JF)

12995 **(NEI-DK—131) Risoe annual report 1987.** (Risoe National Lab., Roskilde (Denmark)). Jun 1988. 40p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756200/JAW.

With selected list of staff publications.

An explanation of Risoe National Laboratory's function within the Danish research system is followed by brief accounts of research activities at Risoe during 1987. Energy resources, technology and policy are discussed, the annual accounts are presented, a guide to the National Laboratory and a list of its publications are given. Some of the research activities that took place in 1987 described in more detail are within the fields of chemistry and the environment, superconductivity, new aspects of powdery mildew, polymers and robotics. (AB).

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 12649, 12685, 12736, 12863, 12864, 12989, 13306, 13307, 13472, 13473, 13557, 13905

12996 **(AECL—7990) Nuclear technology in Canada. Distinguished achievements...an exciting future.** (Atomic Energy of Canada Ltd., Ottawa, Ontario). 1983. 34p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704978/JAW.

This pamphlet provides a summary of the research being carried out by Atomic Energy of Canada Limited. The design and development of the CANDU type reactor are highlighted and the contribution of nuclear technology to medicine, agriculture and the Canadian economy is briefly discussed.

12997 **(INIS-mf—11886) Opinions and statements of the experts who studied the framework conditions of abandonment of nuclear power - presented by the OeTV Executive Board (Public Services and Transport Workers' Union). Annexes.** (Gewerkschaft Oeffentliche Dienste, Transport und Verkehr (OeTV), Stuttgart (Germany, F.R.). Hauptvorstand). Oct 1987. 266p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88756502/JAW.

This second volume contains five annexes to the first volume, presenting in Annex 1 data, facts, tables and comments on the following topics: Electricity demand and supplies; possibilities of reducing electricity demand; alternative energy sources for electricity generation to replace the nuclear energy source; electricity imports; the costs arising from abandonment of nuclear power; environmental burdens and hazards of a power industry with or without nuclear energy. Annex 2 presents terms and definitions, and the remaining three annexes contain literature lists of the expert opinions. (HSCH).

12998 (UTNL-R—212, pp 18-25) **Australia's unresolved nuclear problems. Education and realism.** Kemeny, L.G. (New South Wales Univ., Kensington (Australia)). Nov 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780050/JAW. (CONF-8709395—).

From Adhoc nuclear workshop: nuclear electric power base in the Asia-Pacific; Tokyo, Japan (4 Sep 1987).

This paper examines three acts of monumental incompetence which have all but destroyed Australia's once great potential to play a leading role in nuclear technology in South East Asia. Political chicanery and monumental technological and economic foresight, professional weakness and vacillation in the engineering community and the vicious pseudo scientific propaganda of most branches of the media, the teaching profession and sadly, even the politicisation of our churches, has all but destroyed a potential Australian "sunrise industry". Over the next forty years the population of planet Earth will approximately double. Unless Australians realise that their children and grand-children, and future generations of our neighbouring third world countries will require nuclear technology for an equitable and acceptable shared life-style, they will continue to allow taxpayers' money to be wasted on costly, technically unacceptable and environmentally undesirable attempts to develop "alternative" or "renewable" energy sources. These are neither alternative nor renewable but politically trendy. The tragedy of such projects is that their limited applicability and suitability for small scale energy production by wealthy users in limited geographical locations will only increase the need for base load energy supplies of the conventional type. Unless this is nuclear, planet Earth faces environmental despolation of monumental proportions. (J.P.N.).

12999 (UTNL-R—212, pp 41-63) **Nuclear energy for technology and industry. The safe, clean, cheap and inevitable option.** Kemeny, L.G. (New South Wales Univ., Kensington (Australia)). Nov 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780050/JAW. (CONF-8709395—).

From Adhoc nuclear workshop: nuclear electric power base in the Asia-Pacific; Tokyo, Japan (4 Sep 1987).

It is a sad commentary on the complete lack of informed realism of the Government and people of Australia that, after thirty years of vacillation and political chicanery, nuclear technology, one of this nation's potential "sunrise industries" is in its death throes. Whilst our third world neighbours, in particular Indonesia, Malaysia, the Philippines, the People's Republic of China and even impoverished Bangladesh are making giant strides to develop an autonomous expertise Australia's potential has been dissipated and its opportunities for leadership and technology transfer lost. By chance this paper was written some weeks before the nuclear accident at Chernobyl (U.S.S.R.) and many years after accidents at the Three Mile Island nuclear power plant (U.S.A.) and the plutonium production reactor at Windscale (U.K.). None of these incidents alter the basic arguments or conclusions contained in this manuscript. (See Appendix). The year 1986 might represent the final opportunity for concerned professionals to seek to improve the quality of public education and information to end "the war against the

atom". It will be necessary to re-motivate the public and private sector of a demoralised technology and to launch it on a road of responsible and successful expansion unshackled by beaurocratic interference. It is the purpose of this paper to examine why the first three decades of nuclear technology in Australia have been so singularly unsuccessful and to discuss a coherent and rational implementation of plans and policies for the future.

13000 (UTNL-R—212, pp 109-118) **Role of Republic of Korea for assisting nuclear power programs in developing countries.** Lee, Byong-Whi. (Korea Advanced Inst. of Science and Technology, Seoul (Republic of Korea)). Nov 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780050/JAW. (CONF-8709395—).

From Adhoc nuclear workshop: nuclear electric power base in the Asia-Pacific; Tokyo, Japan (4 Sep 1987).

The character of requirements for the introduction and execution of a Nuclear Power program and their importance as constraints are discussed in light of Korean experiences. The ways and means to alleviate these constraints are suggested. Based on the analysis and assessments of developing countries likely to introduce Nuclear Power, the role of Republic of Korea in assisting their Nuclear Power programs are defined in terms of her experiences and capabilities for prerequisites, requisites for the success and maintenance of the program.

13001 (UTNL-R—212, pp 119-132) **New nuclear power cooperation among developing and developed countries.** Wakabayashi, Hiroaki. (Tokyo Univ. (Japan). Faculty of Engineering). Nov 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780050/JAW. (CONF-8709395—).

From Adhoc nuclear workshop: nuclear electric power base in the Asia-Pacific; Tokyo, Japan (4 Sep 1987).

Quin-shan 300 Mwe PWER project now in progress in China will certainly allow her to build up confidence in her indegenous capability of the national industry in the design and construction of nuclear power plants of any size. Pakistan has a vigorous nuclear plan to meet its increasing energy demand, extreme deficit of energy resources and of energy selfsufficiency. The electricity demand in Indonesia grew rapidly 11 - 12 %-year (1969 - 1982). Nuclear power capacity requirement by 2000 will be between 1 GWe and 4 GWe, if 18 million tons of coal is available, or between 4 GW and 8 GW, if only 12 million tons is available. Nuclear power developments in developed countries seem to be leveling off; slow growth of power use, uncertainty of the nuclear waste disposal and the safety concerns arising from the TMI-2 and Chernobyl-4 core accidents. Indeed, fast breeder reactor development is delayed worldwide. Under these circumstances, nuclear power development both in developing and developed countries need to be appropriately redesigned into having reasonable compromise between energy security and national sovereignty for developing countries in their searches for an international cooperation with and a technology transfer from the developed countries. (Nogami, K.).

13002 **(UTNL-R—212) Praoceedings of the adhoc nuclear workshop: nuclear electric power base in the Asia-Pacific. Implications of peaceful nuclear cooperation and collaboration in the Asia-Pacific Region.** (Tokyo Univ., Tokai, Ibaraki (Japan). Nuclear Engineering Research Lab.). Nov 1987. Vp. (CONF-8709395—). NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780050/JAW.

From Adhoc nuclear workshop: nuclear electric power base in the Asia-Pacific; Tokyo, Japan (4 Sep 1987).

Individual papers are abstracted and indexed separately.

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 12814, 12983

2910 Conservation

REFER ALSO TO CITATION(S) 13023, 13024, 13036, 13052, 13053, 13057

13003 **(DFVLR-MITT—88-22) Horizons of new energy technologies.** Winter, C.J.; Nitsch, J. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V. (DFVLR), Stuttgart (Germany, F.R.). Forschungsbereich Energetik). (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). 1988. 49p. (In German). (CONF-8804196—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756397/JAW.

From 25. international meeting of the Energy Department of Cologne University: new energy technologies, alternative energy, sources, non-conventional energy resources; Koeln, F.R. Germany (21 Apr 1988).

The report points out three items, leading to new energy technologies. (1) Consistent conservative energy usage in locally appropriate supply of the energy services heat, light, power, and communication. (2) Utilization of indigenous solar energy in its variety of passive utilization: Irradiation, ambient heat, wind, water power, and biomass. (3) Solar energy import by means of solar hydrogen at the end of the adaption process. Lack of energy raw materials will be the main characteristic of these future aspects. Energy technologies will dominate. (orig.) With 14 figs., 12 refs.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 12595, 12977, 12979, 13009, 13476

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 12893, 12988, 13306, 13307, 13616

13004 **(PB—89-123533/XAB) Integrated national energy planning and management: methodology and application to Sri Lanka. World Bank technical paper.** Munasinghe, M.; Meier, P. (International Bank for Reconstruction and Development, Washington, DC (USA)). 1988. 195p. (WORLD-BANK-TP—86). NTIS MF A01.

See also PB—89-123525. Library of Congress catalog card no. 88-27872.; Microfiche copies only. Paper copy available from World Bank, 1818 H St., NW, Washington, DC 20433.

Given the importance of energy in modern economies, the first part of the volume is devoted to examining some of the key conceptual and analytical tools available for energy-policy analysis and planning. Policy tools and institutional frameworks that will facilitate better energy management are also discussed. Energy-policy analysis is explained, while effective energy management techniques are discussed to achieve desirable national objectives, using a selected set of policies and policy instruments. In the second part of the volume, the actual application of the principles set out earlier is explained through a case study of Sri Lanka. The monograph integrates the many aspects of the short-term programs already begun with the options for the medium to long term, and ends with the outline of a long-term strategy for Sri Lanka.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 12593, 12594, 12595, 12607, 12616, 12617, 13036

13005 **(DOE/EIA—0035(88/09)) Monthly energy review, September 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 22 Dec 1988. 137p. NTIS, PC A07/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89005530/JAW.

This report presents statistical data on the sources and supplies of petroleum and petroleum products. This volume features articles on generation of electricity by electric utilities and nuclear power plants and on world crude oil production.

13006 **(PB—89-121404/XAB) Analysis of indicators for socio-economic impacts due to OCS (Outer Continental Shelf) oil and gas activities in the Gulf of Mexico, Year 2. Volume 1. Final report.** (Resource Economics and Management Analysis, Inc., Lincoln, NE (USA)). Jul 1987. 128p. NTIS, PC A07/MF A01.

See also PB—86-246188.

In 1984, the Minerals Management Service (MMS) initiated a series of studies to study the direct and indirect impact of resource-development projects in the Gulf of Mexico region. A report, following Year 1 of the study, was published in January 1986 in a 3-volume set (OCS Study/MMS 86-0014, 86-0015, and 86-0016). This report, also prepared in three volumes, describes the second year of such socio-economic studies. Volume I presents the objectives of the Socioeconomic Assessment Model (SAM), a detailed description of the study area, the methods and approach used for measuring socio-economic impacts, the socio-economic impact estimates results and interpretation, and a description of the model's four components: (1) data base--contains all files used in model development and impact assessment; (2) input-output--generates industry output, income, and employment effects for coastal areas; (3) demographic--calculates population effects at the MMS coastal-area level that are consistent with estimated employment effects; and (4) output - summarizes, in tabular form, the estimated socio-economic effects for reporting purposes.

13007 **(PB—89-121412/XAB) Analysis of indicators for socio-economic impacts due to OCS (Outer Continental Shelf) oil and gas activities in the Gulf of Mexico, Year 2. Volume 2. Final report.** (Resource Economics and Management Analysis, Inc., Lincoln, NE (USA)). Jul 1987. 160p. NTIS, PC A08/MF A01.

See also Volume 3, PB—89-121420 and PB—86-246196.

In 1984, the Minerals Management Service (MMS) initiated a series of studies to study the direct and indirect impact of resource-development projects in the Gulf of Mexico region. A report, following Year 1 of the study, was published in January 1986 in a 3-volume set (OCS Study/MMS 86-0015, 86-0015, and 86-0016). This report, also prepared in three volumes, describes the second year of such socio-economic studies. Volume II introduces the basic analytical structure of the Socio-economic Assessment Model (SAM), detailing the four components discussed in Volume I. It also presents the operation procedures for the macros contained in the SAM system and gives a summary of the commands, with options for data management (including data transfer-ability to/from disk), input-output modeling, and economic-impact assessment.

13008 **(PB—89-121420/XAB) Analysis of indicators for socio-economic impacts due to OCS (Outer Continental Shelf) oil and gas activities in the Gulf of Mexico, Year 2. Appendix to Volume 2. Final report.** (Resource Economics and Management Analysis, Inc., Lincoln, NE (USA)). Jul 1987. 243p. NTIS, PC A11/MF A01.

See also Volume 2, PB—89-121412.

In 1984, the Minerals Management Service (MMS) initiated a series of studies to study the direct and indirect impact of resource-development projects in the Gulf of Mexico region. A report, following Year 1 of the study, was published in January 1986 in a 3-volume set (OCS Study/MMS 86-0014, 86-0015, and 86-0016). This report, also prepared in three volumes, describes the second year of such socio-economic studies. This volume contains seven appendices to Volume II: (1) Appendix A--Socio-economic Assessment Model (SAM) and Documentation; (2) Appendix B--National Use and Make Directory; (3) Appendix C--The 116-Sector Aggregation Directory; (4) Appendix D--Price Index Directory; (5) Appendix E--County Business-Patterns Industry Codes; (6) Appendix F--CBP.FTN Program; and (7) Appendix G--SAM Macros.

2960 Electric Power

REFER ALSO TO CITATION(S) 12814, 12816, 12817, 12827, 12829, 12832, 12971, 12972, 12977, 12979, 12982, 12997, 13317

13009 **(DOE/EIA—0226(88/10)) Electric power monthly, October 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 12 Jan 1989. 52p. NTIS, PC A03/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89006029/JAW.

The Electric Power Monthly (EPM) focuses on the electric utility industry in the United States. Detailed, plant-level data are contained in the Electric Power Quarterly. More information can be obtained by writing or calling the National Energy Information Center, EI-231, Forrestal Building, Washington, DC 20585, (202) 586-8800. The data in this report are presented for a wide audience including Congress, Federal and State agencies, the electric utility industry, and the general public. The Energy Information Administration (EIA) collected the information in this report to fulfill its data collection and dissemination responsibilities as specified in the Federal Energy Administration Act of 1974 (Public Law 93-275) as amended.

13010 **(EPRI-EM—6087) A guide to annual marketing planning: Final report.** Jacobson, M.; Grasty, M.; Flory, J.; Landon, R. (Electric Power Research Inst., Palo Alto, CA (USA); QEI, Inc., Davis, CA (USA)). Dec 1988. 100p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005743/JAW.

The purpose of this guide is to introduce marketing and marketing planning concepts and to demonstrate how these concepts apply to electric utility demand-side planning programs, and to define the basic steps of an annual marketing planning process. It focuses on the annual marketing plan, which links a utility's long-term strategic business objectives to its day-to-day field marketing activities. When necessary, the role of the annual marketing plan can be expanded to include strategic direction as well. Its intended audiences are marketing managers and staffs responsible for formulating their utility's annual marketing plan. In addition, it provides state and local organizations with technical assistance in marketing planning.

13011 **(ESC-WR—88-31) The principle of cost-effectiveness per market segment and a formalised price methodology for electric power.** Scheele, D. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Dec 1988. 37p. (In Dutch). Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

The by VEEN (Dutch Association of Electric Power Operators) recommended selling prices for electric power are discussed. Based on the tariff structure the distribution of costs of the electric power supply to the different market segments and the individual consumers is dealt with for the Dutch situation. A spread-sheet program to calculate formalised electric power tariffs belongs to this report. The program is written in Symphony and is called Tariff Basic Calculation (TBC). 5 figs., 1 ref., 8 tabs.

13012 **(ESC-WR—88-32) Tariff Basic Calculation. A program for the calculation of the National Basic Tariff.** Verhagen, L. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Dec 1988. 20p. (In Dutch). Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

Within the framework of the project 'Tariff systems and price forming of electric power', a spread-sheet program has been developed to calculate the costs of the electric power supply. The name of this program, written in Symphony 2.0 (English), is Tariff Basic Calculation (TBC). Based on the production data of the public power supply this program calculates the costs of the supply and derivative National Basic Tariffs elements. The program fits in with the Chronological Simulation Model (CSM) of the Energy Study Centre of the Netherlands Energy Research Foundation ECN. All necessary data can be calculated with CSM. 8 figs.

13013 **(GAO/RCED—88-126) Federal electric power.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 1988. 32p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

Bonneville Power Administration, marketer of nearly half of the power used in the Pacific Northwest, announced a possible power rate increase of up to 35 percent for FY 1988-89. In July 1987, the administrator formally proposed a 7.7-percent rate increase. Growth in 1988-89 budgets, uncertainty over revenues that could be expected, and the need for greater assurance that Treasury obligations would be repaid on time, were the three factors that influenced Bonneville's decision for the increase. Bonneville was able to reduce the size of the 1988-89 increase from a possible 35 percent to 7.7 percent primarily by identifying, through information budget reviews with its power users and others, reductions totaling nearly $865 million in its projected budgets.

13014 **(PB—89-123525/XAB) Proposals for monitoring the performance of electric utilities. Technical paper.** (Ernst and Whinney, Washington, DC (USA)). 1988. 259p. NTIS MF A01.

See also PB—88-238274. Library of Congress catalog card no. 88-20849; Microfiche copies only. Paper copy available from World Bank, 1818 H St., NW, Washington, DC 20433.

Recent World Bank studies have shown a declining trend in power-sector performance in the developing countries and recommend giving greater emphasis to rehabilitation and maintenance, and to improving operational performance. This report presents a system for improving electric utility efficiency through the identification and analysis of three sets of performance indicators covering generation, transmission and distribution, and commercial operations. The indicators measure physical inputs and outputs. The system is intended to supplement the more usual financial tests used to measure utility performance, which are not covered in the report.

13015 **(PB—89-851851/XAB) Electric-power load management. January 1982-November 1988 (Citations from the NTIS data base). Report for January 1982-November 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 156p. NTIS PC N01/MF N01.

Supersedes PB—86-861648.

This bibliography contains citations concerning residential, commercial, and industrial load management. Load forecasting, the impact of alternative energy strategies, including dispersed storage and generation, off-peak power utilization, and cogeneration, and communication systems used in distributed control are among the topics presented. Capacity-expansion analysis, the utilization of computer models in forecasting and system planning, and consumer attitudes regarding load control and rate structures are also discussed. (This updated bibliography contains 254 citations, 32 of which are new entries to the previous edition.)

13016 **DOE's least cost utility program.** Millhone, J.P. (Office of Buildings and Community Systems, US Dept. of Energy (US));. pp v of Energy technology XIV. Rockville, MD; Government Institutes Inc. (1987). (CONF-870416—).

From 14. annual energy technology conference and exposition; Washington, DC, USA (14 Apr 1987).

The U.S. Department of Energy (DOE) has initiated a Least Cost Utility Program (LCUP) for the primary purpose of seeking greater certainty about what can be achieved from demand-side programs. Once that greater certainty is achieved, utilities will be able to make wiser decisions as they select a mix of supply-side and demand-side programs. Public utility commissions (PUC's) and other State and Federal regulators will be able to make wiser decisions as they set the rules for utilities. This paper describes the background of the legislation, a survey of research and analytical needs, the current DOE activities, and the plans for disseminating the results of this activity.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 12593, 13009, 13061

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 12766, 12767, 12776, 12777, 12794, 12795, 13003, 13004

13017 **(TNO-TPD—614.010) International activities in the field of testing of solar collectors and solar boiler systems. Annual review 1986.** Keizer-Boogh, E.M. (Nijverheidsorganisatie TNO, Delft (Netherlands). Technisch Physische Dienst). May 1987. 47p. (In Dutch). Technisch Physische Dienst TNO-TH, P.O. Box 155, 2600 AD Delft, Netherlands.

The Institute of Applied Physics (TNO-TH, Netherlands) participates in the International Energy Agency, Task III, as well as in the Solar Collector and Systems Testing Group (CSTG) of the European Community (EC). The work for IEA-III is carried out by order of the Project Management Office Energy Research within the framework of the National Research Program Solar Energy. Several reports of meetings with regard to the activities as stated in the title are included in this review.

30 DIRECT ENERGY CONVERSION

13018 **(CEA-SPhT—88-077) Energy: A physicist's point of view.** Ripka, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). 1988. 10p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756663/JAW.

The various forms of energy; conservation of energy; kinetic and thermal energy; gravitational energy; nuclear energy; electrical energy; and chemical energy and combustion are reviewed.

3001 Mhd Generators

REFER ALSO TO CITATION(S) 13286

13019 **(AD-A—200258/2/XAB) High-pulsed-power, self-excited magnetohydrodynamic power-generation systems. Final report, 1 November 1984-31 October 1985.** Zauderer, B.; Fleming, E.; Wang, J. (Coal Tech Corp., Merion, PA (USA)). 27 Dec 1985. 132p. (CT—85-10). NTIS, PC A07/MF A01.

The objective of this study was to examine the feasibility of achieving high-power, high-energy, repetitive pulses over a multi-second period, using a portable, self-excited, magnetohydrodynamic (MHD) generator system. To assure a compact, portable system, a room-temperature MHD magnet, and operation without a supersonic diffuser was assumed. The approach selected was to use a c-w, self-excited, MHD generator to provide the power for the magnetic field in a shaped-explosive, argon-plasma, MHD generator. The latter's output power pulses are converted in a pulse shaping network to the ultimate load. For the c-w generator, a novel system consisting of a nonequilibrium MHD generator, with a noble-gas working fluid, and heated directly with a high-energy chemical fluid, was used. A novel, compact room-temperature magnet was used with the c-w MHD generator. This generator's system power output per unit volume and per unit total system weight is much higher than the values obtainable in high energy liquid or solid-rocket-fuel driven, combustion MHD generators. Among the barrier problems to the use of the shaped explosive, the argon-plasma MHD generator is survival of all the components for more than one pulse. It was found that the use of the novel c-w MHD generator system directly with a pulsed-forming network, and completely eliminating the explosive generator, resulted in a superior system performance compared to the best levels projected with advanced explosive and combustion MHD generators.

13020 **(DOE/PC/90255—T2) Coal-Fired MHD Combustor Development Project: Phase IV, Final technical report, April 10, 1987--September 23, 1988.** (TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div.). 23 Sep 1988. Contract AC22-87PC90255. 265p. (MHD-IV—089). NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002168/JAW.

This report presents the results and accomplishments of Phase IV activities culminated with the shipment of two key combustion system components to the DOE Component Development and Integration Facility (CDIF) in Butte, Montana. Integrated testing of the 50 MW/sub t/ workhorse slagging coal combustor in conjunction with the 1A1 power train will directly support the ongoing MHD Integrated Topping Cycle Proof-of-Concept (POC) Program. The scope of the effort completed included: the fabrication, assembly, hot-fire checkout testing and shipment to the CDIF of a low preheat coal-fired precombustor; the procurement and shipment to the CDIF of a continuous slag removal and electrical isolation system; and the continuation of on-site engineering and hardware repair activities in support of 50 MW/sub t/ power train testing at CDIF. 86 figs., 20 tabs.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 12974, 13269

13021 **(EPRI-AP—5609) Conceptual design of a 100-MW fuel cell power plant for urban utility applications: Final report.** Handley, L.M.; Healy, H.C.; Clausi, J.V.; Hall, E.W.; May, G.W.; Oesterich, L.C. (Electric Power Research Inst., Palo Alto, CA (USA); International Fuel Cells Corp., South Windsor, CT (USA); Bechtel National, Inc., San Francisco, CA (USA)). Dec 1988. 149p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004483/JAW.

This report summarizes the results of EPRI Research Project RP1777-1, Amendment 13. The objective of this work was to define the performance, cost, and configuration of conceptual 100-megawatt fuel cell stations for in-city generation. The study assumed an IFC-developed scenario for introduction of multi-megawatt phosphoric acid fuel cells for electric utility applications. The technology basis of the designs is the IFC 11-megawatt PC23 fuel cell power plant. The PC23 design was extended to produce a 25-megawatt module from the PC23 frame. Two 100-megawatt stations made up of four 25-megawatt modules each were chosen as examples of urban installations. One is intended for unconstrained sites on open land; the other is suitable for constrained sites such as existing buildings. The study concluded that large fuel cell plants can be derived from current technology and that they would have attractive characteristics. There is the potential for hundreds of megawatts of fuel cell capacity in the New York metropolitan area on Con Edison property. The installed cost is less than $1000 per kilowatt (1987 dollars) at reasonably low production rates. The O and M cost is in the range of 7--8 mills per kilowatt-hour. An advanced PAFC system design was defined which could evolve from the baseline 100-megawatt plant. Performance and cost characteristics of that system appear even more attractive and provide a strong incentive for continued R and D and investment in PAFC technology. 32 figs., 37 tabs.

13022 **(EPRI-AP—6124) Availability assessment of 11-MW phosphoric acid fuel cell power plants: Final report.** Juliano, J.J.; Reilly, M.C.; Wone, K.B. (Electric Power Research Inst., Palo Alto, CA (USA); Arinc Research Corp., Annapolis, MD (USA)). Dec 1988. 40p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005225/JAW.

ARINC Research Corporation performed an assessment of the expected availability of the prototype International Fuel Cells 110MW PC23 fuel cell power plant design using the UNIRAM availability assessment methodology to obtain an independent estimate of its long-term availability. A 90.32% availability value was predicted by the UNIRAM assessment, which appears to be consistent with previous estimates of unit availability for fuel cell plants of this type. A list of components ranked in order of criticality was developed to determine those components whose failure would most adversely affect unit availability. The criticality listing for the PC23 plant design showed components for which improvements to mean time between failures or mean downtime could be expected to result in a significant improvement to unit availability. Certain subsystems represented by components also appeared high in the ranking, indicating that individual components of high criticality may exist within those subsystems. Improvements to the availabilities of these subsystems would provide further improvement to unit performance. The effect of derating on the cell stack assemblies was also investigated. The substantial improvement in the unit availability prediction attributable to the modeling of the derated states indicates the potential benefit of identifying all operating scenarios that could possibly take advantage of the opportunities for derating in the plant and modeling them to assess their impact on overall unit performance. 9 refs., 8 figs., 8 tabs.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 14100

13023 **(DOE/CH/10093—35) A compendium of energy conservation success stories.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of the Deputy Assistant Secretary for Conservation). Sep 1988. Contract AC02-83CH10093. 51p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000817/JAW.

Three-quarters of DOE's Conservation R and D funds have been devoted to technology research and development: basic and applied research, exploratory R and D, engineering feasibility studies, pilot-scale prototype R and D, and technology demonstration. Non R and D projects have involved technology assessment program planning and analysis, model development, technology transfer and consumer information, health effects and safety research, and technical support for rule making. The success stories summarized in this compendium fall into three general categories: Completed Technology Success Stories, projects that have resulted in new energy-saving technologies that are presently being used in the private sector; Technical Success Stories, projects that have produced or disseminated important scientific/technical information likely to result in future energy savings; Program Success Stories, non-R and D activities that have resulted in nationally significant energy benefits. The Energy Conservation research and development program at DOE is managed by the Office of Conservation under the direction of the Deputy Assistant Secretary for Conservation. Three subordinate Program Offices correspond to the buildings, transportation, and industrial end-use sectors. A fourth subordinate Program Office{endash}Energy Utilization Research{endash}sponsors research and technical inventions for all end-use sectors.

3201 Buildings

REFER ALSO TO CITATION(S) 12603, 12738, 12781, 13078, 13180, 13313, 13504, 13534

13024 **(DOE/CE/64607—T1) Tennessee's Tier I Program: Final report.** (Tennessee State Government, Nashville (USA)). [1989]. Contract FG01-86CE64607. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005756/JAW.

This report examines the activities of each of the Centers for Energy Efficiency and the performance contracting demonstration. It reviews the specific achievements and problems of each program component, and assesses the general successes and failures of the overall Tier I program. The report will conclude with an assessment of Tennessee's Tier I program with respect to the subjects of innovation, applicability, self-sufficiency, leverage and linkage, capability and impact on the target audience.

13025 **(DOE/CH/10093—32) Programs in energy conservation: Buildings and community systems.** (Solar Energy Research Inst., Golden, CO (USA)). Dec 1988. Contract AC02-83CH10093. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000804/JAW.

The mission of the US Department of Energy's (DOE) Office of Buildings and Community Systems (OBCS) is to lead a national effort to achieve maximum, cost-effective energy production in the buildings sector. The energy efficiency of buildings, building equipment and community systems impacts our economic productivity and national security. Therefore, OBCS is working to achieve greater energy savings in the buildings sector while maintaining healthy indoor environments minimizing the cost of energy services to consumers, and enhancing the international competitiveness of our construction and building equipment industries. This report contains an overview of research programs in energy conservation.

13026 **(DOE/ER—0399) Radon epidemiology: A guide to the literature.** Marks, S. (USDOE Assistant Secretary for Environment, Washington, DC. Office of Health and Environmental Research). Dec 1988. 136p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006398/JAW.

This document was written as a comprehensive overview of the voluminous literature on both uranium miner and residential radon epidemiology studies. This document provides the reader with a fairly complete list of radon epidemiology publications and key features of each, so that readers may further pursue only those publications of interest in the vast body of radon literature. A companion document, exploring all on-going residential radon epidemiology studies will be published by the Office of Health and Environmental Research (OHER), the Department of Energy (DOE) in the spring of 1989.

13027 **(DOE/ER/60665—T1) Geology and geochemistry of radon in shear zones: End of year progress report.** Gundersen, L.C.S.; Schultz, A.P.; Wanty, R.B.; Gates, A.E.; Crespi, J.M. (Geological Survey, Reston, VA (USA)). 1989. Contract AI05-88ER60665. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006092/JAW.

The objective of this project is to understand the geology of radon gas behavior in areas where shared fault zones cause localized, anomalously high concentrations of radon. Sheared fault zones in bedrock have been identified as the cause of some of the highest indoor radon and water borne radon problems recorded in the United States. This study will provide detailed geological and geochemical models of the processes that create high concentration of radon in shear zones. The main research goals are to: (1) characterize and quantify uranium enrichment in shear zones by examining the chemical and deformational processes involved; (2) develop predictive models that will identify severe radon occurrences by rock type, amount of deformation (shear strain), deformational style, and amount of radionuclide enrichment; (3) characterize and quantify the effect of deformation on the development of soils, permeability, radon migration and emanation, alteration, and radium distribution; (4) characterize and quantify the rock-water equilibria within shear zones that produce the extreme concentrations of radon in water derived from sheared rock aquifers, and examine the contribution of radon in water to indoor radon concentrations. 4 refs.

13028 **(IBP-GB—12/85) Shutters - thermal insulation and noise pollution abatement. Acoustic aspects.** Koch, S.; Benavent-Gil, M. (Fraunhofer-Institut fuer Bauphysik, Stuttgart (Germany, F.R.)). 2 Jul 1986. 81p. (In German). Fraunhofer-Institut fuer Bauphysik, Stuttgart (Germany, F.R.).

Exemplary preliminary tests investigating into the thermal insulation and noise insulation characteristics of a cased shutter window system aimed at the development of optimized shutters the armor spacing of which would provide for equally good thermal insulation and noise insulation values. According to the results obtained window-shutter designs optimized the way described require different pane/armor spacings. Thermal insulation turned out to be at its best with spacings smaller than 100 mm. With additional mineral fiber absorption materials between shutters and panes the airborne noise insulation index was found to be by 3 to 4 decibel higher than that of conventional window system. Details are given on the measuring method, the variation of armor spacings, slat fillings both with regard to the spacing of armors and with regard to the influence of slat fillings, and on shutters for highly noise-insulated windows. (BR) With 2 tabs., 10 figs.

13029 **(ORNL/CON—269) Results of workshop to develop alternatives for insulations containing CFCs [chlorofluorocarbons] research project menu.** Christian, J.E.; McElroy, D.L. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 146p. (CONF-8806298—Summ.). NTIS, PC A07 - OSTI. Order Number DE89005709/JAW.

From Joint public/private workshop on alternatives for insulations containing chlorofluorocarbons (CFCs); Washington, DC, USA (9 Jun 1988).

Sixty-nine individuals from 43 organizations impacted by CFC restrictions in the production of insulations met for two days to produce a relevant, comprehensive and prioritized list of research needs. Of the 29 one page research project descriptions, about 75% are candidates for joint private/public sector research ventures. Top priority research projects are: development of a data base of physical properties of substitute blowing agents; protocol to predict thermal performance of cellular foam insulation products; identify new blowing agents; environmentally acceptable blowing agents and means to achieve equivalent efficiency; new facing materials; CFC manufacturing recovery processes; and low k standard reference material. Based on the data base produced by balloting, five research projects have statistically above average importance, five have below average importance, and the remainder have average importance. The prioritized research list presented in this report should be considered as only one of a number of inputs for allocating research and development resources. There are many promising activities outlined in this report and this material should be useful in developing research plans and formulating research work statements. It is obvious that there are numerous areas where cooperative research ventures could be established. Hopefully this document will form a starting point in accelerating the solution to the CFC problem for insulations. 7 refs., 4 figs., 14 tabs.

13030 **(ORNL/Sub—84-89634/2) Steady state radiative heat transfer through insulations.** Klemens, P.G.; Kim, N. (Oak Ridge National Lab., TN (USA); Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Mechanical Engineering). Aug 1988. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89001327/JAW.

The radiative component of the thermal conductivity is expressed in terms of a spectral distribution and a frequency dependent photon attenuation length. This length is limited by specimen thickness, by absorption and by scattering. This treatment disregards absorption. The radiative transfer spectrum can have two peaks in the case of fibers and particles: a thermal peak and a peak at low frequencies. In those cases the radiative component departs strongly from a cubic temperature dependence. In the case of foams, there is only one peak, the thermal peak, and departures from cubic variation are smaller. The radiative component is calculated for some representative cases of fibers and foams. Deterioration of the insulating quality of foams could be caused not only by air infiltration but by surface-tension driven thinning of walls. 7 refs., 3 tabs.

13031 **(ORNL/TM—11009) ZIP - The ZIP-Code Insulation Program (version 1.0) economic insulation levels for new and existing houses by three-digit ZIP code: Users guide and reference manual.** Petersen, S.R. (Oak Ridge National Lab., TN (USA)). Jan 1989. Contract AC05-84OR21400. 44p. (NISTIR—88-3801). NTIS, PC A03/MF A01 - OSTI - Order software packages from National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS; 1; GPO Dep. Order Number DE89005942/JAW.

ZIP 1.0 (the ZIP-code Insulation program) is a computer program developed to support the DOE Insulation Fact Sheet by

providing users with customized estimates of economic levels of residential insulation. These estimates can be made for any location in the United States by entering the first three digits of its ZIP Code. The program and supporting files are contained on a single 5.25-in. diskette for use with microcomputers having an MS-DOS operating system capability. The ZIP program currently calculates economic levels of insulation for attic floors, exterior wood-frame and masonry walls, floor over unheated areas, slab floors, and basement and crawlspace wells. The economic analysis can be conducted for either new or existing houses. Climate parameters are contained in a file on the ZIP diskette and automatically retrieved when the program is run. Regional energy and insulation price data are also retrieved from the ZIP diskette, but these can be overridden to more closely correspond to local prices. Zip can be run for a single ZIP Code and specified heating and cooling system. It can also be run in a "batch" mode for any number of consecutive ZIP Codes in order to provide a table of economic insulation levels for use at the state or national level. 4 tabs.

13032 **(PB—89-124440/XAB) Fan door testing on crawlspace buildings. Report for August 1987-June 1988.** Brennan, T.; Pyle, B.; Osborne, M. (Southern Research Inst., Birmingham, AL (USA)). Nov 1988. 12p. NTIS, PC A03/MF A01.

ThIS paper discusses: (1) fan door testing of crawl spaces in nine buildings in Tennessee, and (2) using two fan doors to estimate the leakage area of the floor between the crawl space and the living space. The testing gives some insight into the tightness of crawl spaces and the leakage area through the floor between them. It has been observed that: (1) even with vents closed, the crawl spaces tested are leakier than the houses they support; (2) the leakage area between crawl spaces and living spaces is a large fraction of the overall building leakage; and (3) HVAC ductwork increases the leakage area between the two spaces dramatically (four of the nine test houses had ductwork). Currently, these crawl spaces are being modified to reduce indoor radon concentrations by sealing the crawl space as tightly as possible, and by sealing only the floor between the crawl space and the living space.

13033 **(PB—89-127948/XAB) Healthy buildings '88. Volume 1. State-of-the-art reviews (Revue de l'etat de la technique).** Berglund, B.; Lindvall, T. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). Jun 1988. 192p. NTIS, PC E07/MF A01.

The Conference on Building Design and Architecture organized by Swedish Council for Building Research Contents included articles on building physics, thermal-climate technology, indoor-air-quality technology, construction materials, quality assurance, and building policy and regulation.

13034 **(PB—89-127955/XAB) Healthy buildings '88. Volume 2. Planning, physics, and climate technology for healthier buildings (Planning, physique et technologie du climat pour des constructions plus saines).** Berglund, B.; Lindvall, T. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). Jun 1988. 699p. NTIS, PC E19/MF A01.

The Conference on Building Design and Architecture organized by Swedish Council for Building Research Contents included articles on building physics, thermal-climate technology, and building location and planning.

13035 **(PB—89-127963/XAB) Healthy buildings '88. Volume 3. Systems, materials, and policies for healthier indoor air (Systemes, materiaux et politique pour un air interieur plus sain).** Berglund, B.; Lindvall, T. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). Jun 1988. 715p. NTIS, PC E19/MF A01.

The Conference on Building Design and Architecture organized by Swedish Council for Building Research Contents included articles on indoor-air-quality technology, construction materials, quality assurance, and building policy and regulation.

13036 **(PB—89-131130/XAB) Analysis and categorization of the office building stock. Topical report, February-September 1987.** Briggs, R.S.; Belzer, D.B.; Crawley, D.B. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1987. 192p. NTIS, PC A09/MF A01.

Advanced gas technologies for the commercial-building sector are currently being developed by GRI. Basic information regarding the commercial-building population, such as floor space, age, HVAC type, and energy consumption, will aid in properly targeting these R&D efforts. The categories developed in this study allow users to focus studies for gas-fired equipment on specific segments of the nation's office building sector. Categories of office buildings were developed using a statistical technique known as cluster analysis, which was used to group observations on the basis of similarities with respect to various attributes. Categories were defined on the basis of physical attributes such as size, age, and location and on building energy loads. The categories were designed to represent the entire office-building sector with a limited number of categories while reflecting as much of the diversity within the sector with respect to energy as possible.

13037 **(PB—89-131924/XAB) Friability of spray-applied fireproofing and thermal insulations: laboratory evaluation of prototype test devices.** Rossiter, W.J.; Roberts, W.E.; Mathey, R.G. (National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Center for Building Technology). Nov 1988. 80p. (NISTIR—88/3848). NTIS, PC A05/MF A01.

See also PB—88-169826.

This report describes the results of the second phase of a study to develop a field test method for assessing the friability of spray-applied fireproofing and thermal-insulating materials. Phase 2 is the laboratory evaluation of the prototype devices for conducting surface and bulk compression/shear, indentation, abrasion, and impact tests. The results indicated that the surface and bulk compression/shear, indentation, and impact devices provided some measure of discrimination between samples subjectively judged as having high and moderate friability. In contrast, the abrasion device was non-discriminating in that, for all tests, a residue was produced. It was concluded that all devices be included in the field phase of the study using in-place spray-applied fireproofings having different levels of friability.

13038 **(PNL—6774) Radioluminescent emergency egress lighting for US Navy surface ships.** Adrian, D.K.; Pusey, H.C.; Jensen, G.A.; Traub, R.J. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 104p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005697/JAW.

This very limited study examines only one of a number of shipboard applications to which (RL) might be applied. A detailed analysis is needed to fully explore the potential for use of state-of-the-art RL systems in the Navy. A more comprehensive study is highly recommended. It was also not possible to assess the implications of emerging RL technologies such as solid matrix light development and advanced gas techniques; it is strongly recommended that continued research level efforts do this. Nonetheless, for the emergency egress application, enough conclusive evidence was developed and critical questions answered to indicate that the RL option using current technology can economically improve emergency egress and crew safety significantly on Navy ships. 18 refs., 9 figs., 7 tabs.

13039 **(SERI/TR—254-3440) Mobile home weatherization measures: A study of their effectiveness.** Judkoff, R.; Hancock, E.; Franconi, E.; Hanger, R.; Weiger, J. (Solar Energy Research Inst., Golden, CO (USA)). Dec 1988. Contract AC02-83CH10093. 69p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000824/JAW.

The Solar Energy Research Institute (SERI) was funded by the Department of Energy's Office of Buildings and Community Systems (DOE OBCS) in FY 1987 and 1988 to investigate cost effective ways to weatherize mobile homes constructed prior to the enactment of HUD Thermal Standards in 1976. In FY 1987 SERI studied the effectiveness of a variety of infiltration-reducing retro-

fits by monitoring 20 units in the field before, during, and after applications of air tightening measures. In FY 1988 we began studying measures intended to reduce envelope conduction losses. These measures included storm windows, insulated skirting, and wall, roof, and floor insulation. This part of the project resulted in the development of a short-term testing method for measuring the thermal impact of individual conduction-reducing retrofits.

13040 **(TNO-HMT—88-271) Demonstration of energy savings by application of pole-reversible electromotors in refrigeration compressors.** Koppenol, A.D. (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). Sep 1988. 33p. (In Dutch). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756342/JAW.

Under the authority of NOVEM BV, Netherlands Agency for Energy and Environment, the Apeldoorn based branch of the Division of Technology for Society TNO of the Netherlands Organisation for Applied Scientific Research has demonstrated savings in electric power consumption of industrial refrigeration compressors. This is realized by application of pole-reversible electromotors which enable speed reduction of the motor. The possibility of speed reduction of the electromotor results in capacity/output control of the compressor. The test facility uses a 4-cylinder refrigeration compressor having a capacity of 30 kW at -10 to 30 C. Test facility and measuring procedures are described; test results are given in comparison with valve lift methods. Different coolants are tested. 7 figs., 2 refs., 6 tabs.

13041 **(TNO-TPD—414.215) Control strategies and heating systems at a layered storage.** Dalhuijsen, A.J. (Nijverheidsorganisatie TNO, Delft (Netherlands). Technisch Physische Dienst). Jul 1987. 86p. (In Dutch). Technisch Physische Dienst TNO-TH, P.O. Box 155, 2600 AD Delft, Netherlands.

The connection of a heat distribution system for space heating to a solar heating system with layered storage has been studied. The influence of design and control of the heat distribution system on the thermal stratification in the storage and with it on the energy yield of the system is determined. It is indicated which needs the heat distribution system has to meet in order to utilize the stratification in an optimal way. It is concluded that a collector flow control is thermally favorable. The differences in system yield at different control and design of the collector circuit and the heat distribution system are mainly a consequence of different operation periods. Also it is concluded that for a great number of the investigated configurations the influence of the heat distribution systems on the energy yield is limited. 70 figs., 7 refs., 11 tabs., 3 apps.

13042 **(ANL-Trans—88-2) Heating plants fired by fuel oil or diesel fuel.** (Argonne National Lab., IL (USA)). 8 Dec 1988. Contract W-31109-ENG-38. Translation of Circular No. 73, September 29, 1971. 40p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005357/JAW.

This manual contains safety standards to be applied to design, install, and operate heating plants, which are fired by liquid fuels and have a capacity greater than 30,000 Kcal/h and up to 4,000,000 Kcal/h. These heating plants also have a flash point not lower than 55{degree}C and distillate not greater than 2% of the total by volume at 150{degree}C. The manual includes structural, piping, and tank specifications for construction warehouse facilities and industrial plants. 15 figs., 3 tabs. (TC)

13043 **Source replenishment device for vacuum deposition.** Hill, R.A. (to Dept. of Energy, Washington, DC). US Patent 4,776,299. 11 Oct 1988. Filed date 15 May 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a mechanism for providing replenishing source material to a heating element for vaporizing the source material within a vacuum chamber of a vacuum deposition apparatus, comprising: (a) vertically disposed moveable support means having an upper and a lower end and located within the vacuum chamber for movably supporting a plurality of source material elements adjacent the heating element at the upper end thereof; (b) motion producing means located within the vacuum chamber and operably connected to the moveable support means for producing intermittent motion of sid moveable support means for moving the source material elements supported thereby, one material at a time, into contact with the heating element and having (1) means for imparting to the support means both linear motion along a predetermined first axis and rotary motion along a predetermined first axis and rotary motion about the first axis of the support means, (2) a circumferentially disposed cylindrical cam having a predetermined cam profile, disposed for rotation about the first axis, and (3) cam follower means connected to the movable support means for following the cam profile, to thereby generate the linear motion of the moveable support means; (c) drive means located outside the vacuum chamber for controlling operating the motion producing means outside the vacuum chamber; and (d) first gearing means operably connected between the cylindrical cam and the drive means and second gearing means operably connected between the moveable support means and the drive means, to thereby generate the rotary motion of the moveable support means.

13044 **Developments in U.S. gas heat pump technology.** French, C.E. (Residential Heat Pumps, Gas Research Institute, Chicago, IL (US));. pp v of Energy technology XIV. Rockville, MD; Government Institutes Inc. (1987). (CONF-870416—).

From 14. annual energy technology conference and exposition; Washington, DC, USA (14 Apr 1987).

There is a demonstrated, growing acceptance of high-efficiency space conditioning equipment in the HVAC market. This circumstance has resulted in a broad range of research effort pursuing new product in gas heat pump (GHP) technology, aimed at residential and commercial applications. This paper briefly reviews the status of projects that are being sponsored by DOE or GRI.

13045 **(DOE/CE/30752—T4-Vol.2-App.C) Evaluation procedure for building energy performance prediction tools: Volume 2, Background research documentation: Appendix C, Development of design tool categorization method.** (Building Energy Design Tool Development Council #914, Washington, DC (USA)). Jul 1984. Contract AC03-83CE30752. 53p. NTIS, PC A04 - OSTI. Order Number DE89005719/JAW.

The purpose of this report is to describe the development of a method for categorizing building energy design tools. The categorization method was created to be the first step in a research project for the US Department of Energy, the purpose of which is to generate an evaluation procedure for building energy design tools. This categorization method is a necessary first step in the creation of an evaluation procedure, because it will demonstrate and initial segregation of design tools into groups. Each of these groups can then be evaluated according to their requirements. This report will discuss the process which was devised to create a categorization method for building energy design tools, the key resources which were reviewed to assist in this development process, and the final composition of the categorization "tree" diagram. In the context of this report, the words "building energy design tool" refer to a decision-making device which is utilized to judge alternatives in the process of building design. A shortening of the phrase "building energy design tools" to "design tools" is used in this report, and it refers to equivalent definitions.

3202 Transportation

REFER ALSO TO CITATION(S) 12603, 12779, 13353

13046 **(CONF-880932—5) Energy and economic implications of magnetically-levitated vehicles.** Johnson, L.R.; Rote, D.M. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005876/JAW.

From International renewable energy conference; Honolulu, HI, USA (18 Sep 1988).

Maglev systems, if implemented as "spokes" around the nation's major hub airports, have the potential to significantly reduce air traffic congestion. Maglev systems could improve the capacity of existing airports, obviating the need to build major new airports at a time when there is widespread public opposition to both airport expansion and new construction. Because of maglev's

high speed (250-300 mph), the maglev has a logical market niche of trips between 100 and 600 miles. These short distance flights are the most energy intensive for the airlines; consequently, maglevs provide the opportunity to save 10 to 15% of the energy used by the scheduled airlines, through substitution of more efficient transport and reduced delays. Integrated into airline service, rather than competing with airlines, the economics of maglev systems is substantially enhanced. Indeed, a substantial portion of a national maglev system (3000 miles) around several major hub airports could be built over the next twenty years with a portion of the costs that the Federal Aviation Administration calculates are incurred by the airlines and the passengers---nearly $5 billion in 1986. Further, maglevs are the most promising large-scale application for the new class of high temperature superconductors, because of the relatively low threshold design requirements of the magnets compared to other potential applications. In addition, the new superconductors will improve maglev system reliability and may reduce capital and operating costs by as much as 10%. 2 figs.

13047 **(DOE/ER/01198—2484) Al-Li-X alloys for aircraft application: An overview.** Shaiu, B.J.; Chen, H. (Illinois Univ., Urbana (USA). Dept. of Materials Science and Engineering). 1988. Contract AC02-76ER01198. 15p. (CONF-881246—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003849/JAW.

From Engineering materials and technology and modern engineering and technology seminar; Taipei, Taiwan (19 Dec 1988).

This article reviews the historical progress in the development of Al-Li-X alloys which possess high strength, high elastic modulus and low density, ideal for aircraft application. Many technological problems associated with alloying and metallurgical processing are outlined and methods to remedy some of these problems are discussed. 22 refs., 4 figs., 3 tabs.

13048 **(EGG-M—25887) Comparison: Direct thrust nuclear engine, nuclear electric engine, and a chemical engine for future space missions.** Ramsthaler, J.H.; Sulmeisters, T.K. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 5p. (CONF-880122—19). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005273/JAW.

From 5. symposium on space nuclear power systems; Albuquerque, NM, USA (11 Jan 1988).

The need for an advanced direct thrust nuclear rocket propulsion engine has been identified in Project Forecast 2, Air Force Systems Command report which looks into future Air Force needs. The Air Force Astronautical Laboratory (AFAL) has been assigned responsibility for developing the nuclear engine, and they in turn have requested support from teams of contractors who have the full capability to assist in the development of the nuclear engine. The Idaho National Engineering Laboratory (INEL) has formed a team of experts with Martin Marietta for mission analysis. Science Applications International (SAIC) for flight safety analysis, Westinghouse for the nuclear subsystem, and Rocketdyne for the engine system. INEL is the overall program manager and manager for test facility design, construction and operation. The INEL team has produced plans for both the engine system and the ground test facility. AFAL has funded the INEL team to perform mission analyses to evaluate the cost, performance and operational advantages for a nuclear rocket engine in performing Air Force Space Missions. For those studies, the Advanced Nuclear Rocket Engine (ANRE), a scaled down NERVA derivative, was used as the baseline nuclear engine to compare against chemical engines and nuclear electric engines for performance of orbital transfer and maneuvering missions. 3 tabs.

13049 **(MLM—3540-Vol.1) Light-Weight Radioisotope Heater Unit final safety analysis report (LWRHU-FSAR): Volume 1: A. Introduction and executive summary: B. Reference Design Document (RDD).** Johnson, E.W. (EG and G Mound Applied Technologies, Miamisburg, OH (USA)). Oct 1988. Contract AC04-88DP43495. 104p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005494/JAW.

The orbiter and probe portions of the National Aeronautics and Space Administration (NASA) Galileo spacecraft contain components which require auxiliary heat during the mission. To meet these needs, the Department of Energy's (DOE's) Office of Special Applications (OSA) has sponsored the design, fabrication, and testing of a one-watt encapsulated plutonium dioxide-fueled thermal heater named the Light-Weight Radioisotope Heater Unit (LWRHU). This report, prepared by Monsanto Research Corporation (MRC), addresses the radiological risks which might be encountered by people both at the launch area and worldwide should postulated mission failures or malfunctions occur, resulting in the release of the LWRHUs to the environment. Included are data from the design, mission descriptions, postulated accidents with their consequences, test data, and the derived source terms and personnel exposures for the various events. 11 refs., 44 figs., 11 tabs.

13050 **(MLM—3540-Vol.2) Light-Weight Radioisotope Heater Unit final safety analysis report (LWRHU-FSAR): Volume 2: Accident Model Document (AMD).** Johnson, E.W. (EG and G Mound Applied Technologies, Miamisburg, OH (USA)). Oct 1988. Contract AC04-88DP43495. 186p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005495/JAW.

The purpose of this volume of the LWRHU SAR, the Accident Model Document (AMD), are to: Identify all malfunctions, both singular and multiple, which can occur during the complete mission profile that could lead to release outside the clad of the radioisotopic material contained therein; Provide estimates of occurrence probabilities associated with these various accidents; Evaluate the response of the LWRHU (or its components) to the resultant accident environments; and Associate the potential event history with test data or analysis to determine the potential interaction of the released radionuclides with the biosphere.

13051 **(PB—89-115307/XAB) Financing for the future: changing roles in mass transit. Final report.** Krause, R.A.; Patel, D.I.; Gathy, B.D.; Harmon, R.J.; Sebesta, K. (Council of State Governments, Lexington, KY (USA)). Dec 1987. 331p. NTIS, PC A15/MF A01.

This report on how public transit is financed today was written from the point of view of the states' current fiscal condition. While the economic forecast varies from state to state, not one projects a future of growing surpluses. The report documents and analyzes mass-transit funding sources, both past and present, and looks at their future potential. The 12-state overview may help others uncover methods and programs workable in their situations. The survey findings regarding the question - How do states finance their mass-transit programs - show that states use revenues from various sources such as license fees, bond issues, highway user taxes, tolls and so on. States are exploring new funding mechanisms such as special assessment districts, public/private ventures, lottery funds, and so on.

13052 **(PB—89-121255/XAB) Characteristics of urban transportation demand: an update. Final report, 1984-1987.** Levinson, H.S. (Charles River Associates, Inc., Boston, MA (USA)). Jul 1988. 115p. (CRA—784.01). NTIS, PC A06/MF A01.

Supersedes PB—88-166905.

The report presents a selection of updated data on a wide variety of statistics pertaining to urban travel demand. The information supplements earlier data contained in the UMTA handbook, Characteristics of Urban Transportation Demand -- A Handbook for Transit Planners. The report is designed to be used by transportation analysts as a source of data to check the validity and reasonableness of local forecasts developed from traditional planning studies, or as a cross-check on the similarity of travel statistics from one locality to another.

13053 **(PB—89-121321/XAB) Expanding the use of private-sector providers in rural, small urban, and suburban areas. Final report.** (Carter-Goble Associates, Inc., Columbia, SC (USA)). Oct 1987. 105p. NTIS, PC A06/MF A01.

The eight case studies discussed in this report document examples of rural, small urban, and suburban transit and paratransit systems that have been successful in: (1) utilizing private transportation companies; (2) reducing government intervention; and (3) reducing or minimizing their reliance on UMTA funding. Cases that

are diverse in terms of location, operating environment, operating methods, and funding strategies were intentionally selected in order to provide examples potentially useful and relevant throughout the nation. For each case report the reader is given a description of the system, its history, and environment. Operating data and financial statistics are analyzed to show evidence of cost and service efficiency differences between the private-operated service and public-operated service. Where possible, before and after comparisons are given. In other cases, time-series comparisons are given depending upon the type of data available. An assessment of the system's overall impact and its current status in its local setting is also given.

13054 **(SAND—88-2218) Lifetime assessment analysis of Galileo Li/SO_2 cells: Final report.** Levy, S.C.; Jaeger, C.D.; Bouchard, D.A. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1988. 24p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006005/JAW.

Galileo Li/SO_2 cells from five lots and five storage temperatures were studied to establish a database from which the performance of flight modules may be predicted. Nondestructive tests consisting of complex impedance analysis and a 15-s pulse were performed on all cells. Chemical analysis was performed on one cell from each lot/storage group, and the remaining cells were discharged at Galileo mission loads. An additional number of cells were placed on high-temperature accelerated aging storage for 6 months and then discharged. All data were statistically analyzed. Results indicate that the present Galileo design Li/SO_2 cell will satisfy electrical requirements for a 10-year mission. 10 figs., 4 tabs.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 12615, 12803, 12994, 13040

13055 **(CONF-8804220—) Proceedings of the DOE/Industry advanced research and development Sensor Working Group meeting, Appleton, Wisconsin.** Emerson, D.B. (Energetics, Inc., Columbia, MD (USA)). 21 Apr 1988. Contract AC05-85CE40741. 232p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002943/JAW.

From DOE/industry advanced research and development sensor working group meeting; Appleton, WI, USA (21 Apr 1988).

The Department of Energy/Industrial Program (DOE/IP) pulp and paper sensor program undertakes long-term, high risk, applied research and exploratory development activities to expand the generic technology base that supports initiatives by both the DOE end-use conservation programs and private industry, to improve the efficiency of energy conversion and utilization systems. The DOE/IP pulp and paper sensor research program is distinct from other research programs in that: (a) it undertakes directed basic research that is problem oriented; (b) it focuses on solving problems common to more than one energy-consuming sector in anticipation of technology needs that impede achievement of efficiency improvements; and (c) it seeks out, encourages and supports innovative ideas/concepts that: (1) show technical promise; (2) show cost effective potential; (3) are too long-term for industry to pursue on its own; and (4) are capable of engaging industry interest for future investment in further development if successful at the proof-of-concept stage.

13056 **(DOE/CE—0243) The DOE industrial energy conservation program: Research and development in materials development and applications.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Industrial Programs). Dec 1988. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005981/JAW.

Materials are critical to the many industrial processes, and improvements in various materials has increased the energy efficiency of many processes. This brochure describes the Office of Industrial Program's research and development activities in the advancement of materials technology. The purpose of this brochure is to provide interested parties with information on federal industrial energy conservation activities related to materials. The brochure is comprised of the following sections: Materials Development, summarizes the state of materials development and major areas of materials-related research and development by IP; Potential Energy Savings, identifies the potential for energy conservation through advances in materials; Office of Industrial Program's Material Research and Development, describes specific, selected materials-related R and D projects conducted by IP; and R and D Data Base, lists contractor, principal investigator, and location of materials-related R and D efforts sponsored by IP. 11 figs.

13057 **(DOE/EIA—0515(85)) Manufacturing Energy Consumption Survey: Fuel switching, 1985.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 20 Dec 1988. 64p. NTIS, PC A04/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89006028/JAW.

The Manufacturing Energy Consumption Survey (MECS) provides comprehensive data on energy use by manufacturing industries in the United States, including their fuel-switching capabilities. The impact on manufacturing production of an interruption in the supply of a particular fuel can be mitigated if manufacturers have the capability to switch to alternate fuels. Similarly, in a period of substantial changes in the relative prices of fuels, manufacturers that can switch to less expensive fuels will have an economic advantage. Information about the ability of manufacturing establishments to switch to alternative fuels provides valuable information for assessing the nation's vulnerability to supply disruptions and the effects on manufacturers of other changes in energy markets. This report is the second data report based on the 1985 MECS. It provides information on the fuel-switching capabilities of manufacturing industries in the United States. The first report, Manufacturing Energy Consumption Survey: Consumption of Energy, 1985, presented a comprehensive description of energy consumption by manufacturing industries. The MECS covers all manufacturing industries. Not included in this report are mining, agriculture, construction and electric utilities. 4 figs., 14 tabs.

13058 **(DOE/ID/12652—1) Oxygen enriched air production system.** Lagree, D.A. (Union Carbide Corp., Tonawanda, NY (USA). Linde Div.). 15 Nov 1988. Contract AC07-87ID12652. 58p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005746/JAW.

This report summarizes the testing of this advanced Pressure Swing Adsorption (PSA) System used to produce oxygen enriched air (OEA). The objectives of the PSA System were to provide an efficient, flexible, reliable, and cost effective source of oxygen for combustion applications in a simulated industrial furnace. 1 ref., 5 figs., 7 tabs.

13059 **(EGG-M—88471) McClellan Air Force Base plating shop rinse water recycle system.** Miyasaki, D.H.; LaRue, D.M. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 19p. (CONF-8811122—4). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005286/JAW.

From 13. annual environmental quality R and D symposium; Williamsburg, VA, United States (16 Nov 1988).

The Idaho National Engineering Laboratory performed an assessment on the technical and economic viability of a total recycle of the rinse water generated by the Sacramento Air Logistics Center Plating Shop, located in Building 243-G of McClellan Air Force Base. A proposed conceptual design using ion exchange beds for the recycle of plating shop rinse water is presented and evaluated. Laboratory studies indicated that the proposed recycle system meets all functional and operational requirements that were identified. But concern over the amount of waste generated during the process of regenerating the ion exchange columns prompted an evaluation of a reverse osmosis unit, which would function as pretreatment before the ion exchange process. Further studies indicated that the addition of this pretreatment process would improve the performance of the recycle system, but that the cost of construction and operation would be significantly higher. Based on technical and economic evaluations, the ion exchange system is the recommended recycle system for the plating shop. 9 figs.

13060 **(EPRI-GS—6129) Ash-in-concrete model development: Final report.** Dunstan, E.R. Jr. (Electric Power Research Inst., Palo Alto, CA (USA); Dunstan, Inc., Lakewood, CO (USA)). Jan 1989. 331p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005744/JAW.

This report contains the results of a nationwide study of fly ashes collected from 16 different sources. This research provides one of the largest if not the largest single research data base for fly ash concretes. Two samples were collected from each source. The first sample was collected under base-load (normal) operation and the second under upset (other than normal) operations. Each ash sample was tested for standard physical and chemical properties. The ash samples were used in concrete to replace 15 and 30 percent of the cement on a 1 to 1 weight basis. In a few cases, 50 or 60% of the cement was replaced. The concrete was then tested for compressive strength, flexural strength, elasticity, drying shrinkage, set time, freeze/thaw durability and mortars were evaluated for sulfate resistance. A model for each tested property was developed. The most extensive model is an extension of Power's strength model to include factors for fly ashes. Fly Ash concrete elasticity, flexural strength, drying shrinkage and freeze/thaw durability were found to be similar to concretes without fly ash. Set time was found to be extended which could be estimated based on fly ash CaO content. Sulfate resistance was also found to be related to CaO content. 134 figs., 62 tabs.

13061 **(ESC-WR—88-29) Growth and saturation of traditional materials.** Scheele, D. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Dec 1988. 36p. Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

The materials whose production and consumption will be considered are steel, aluminium and the bulk plastics, polyethylene, polypropylene, polystyrene and polyvinylchloride. They all find a very wide range of applications at least for some decades. They all have reached an advanced stage in their product life cycle. That is why they are referred to in the title as traditional materials. This as opposed to the so called new materials, engineering plastics and so on, whose development both in production and application fields still has to crystallize. The concept of the product life cycle will be central in the following. The research on this subject is done as part of a large study on European gas demand and focusses on five EEC countries that have been selected on the basis of the scale of their energy consumption and economic activities: Germany (FRG), France, Italy, the Netherlands and the United Kingdom. They are also the most outstanding petrochemical producers in Europe and they have important steel and aluminium industries. The regional scope of this study implies that sufficient attention ought to be paid to the dynamics of global distribution of production capacities for the materials of interest. It is well known that comparative advantages on regional energy markets play an important role in these distribution processes. 53 figs., 12 refs., 8 tabs., 1 app.

13062 **(PB—89-125967/XAB) Oxygen utilization in activated-sludge plants: simulation and model calibration. Final report, June 1986-June 1988.** Baillod, C.R. (Michigan Technological Univ., Houghton (USA)). Nov 1988. 97p. NTIS, PC A05/MF A01.

The objective of the research described is to apply recent advances in activated-sludge-process modeling to the simulation of oxygen utilization rates in full-scale activated-sludge treatment plants. This is accomplished by calibrating the International Association for Water Pollution Research and Control Model and associated SSSP microcomputer software to operating data at six full-scale activated-sludge treatment plants. Field data were used to calibrate the key biological parameters contained in the model so that the oxygen utilization rates, dissolved oxygen concentrations, mixed-liquor volatile suspended-solids concentrations, and process performance simulated by the model matched the corresponding quantities observed in the treatment plants. The results showed that the model and associated software package provide a useful capability to analyze, simulate, and predict oxygen utilization rates. It was possible to obtain reasonable agreement between the measured and simulated values of oxygen uptake rate, dissolved oxygen concentration, and other process parameters at most of the plants studied.

13063 **(PB—89-126460/XAB) Resource Conservation and Recovery Act. Subtitle C, Hazardous Waste Management, Section 3001, Identification and Listing of Hazardous Waste; Section 261.33, Hazardous Waste from Discarding of Commercial Chemical Products and the Containers and Spill Residues Thereof: background document. Report for January-April 1981.** (Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste). Apr 1981. 170p. (EPA—530/SW-89/005). NTIS, PC A08/MF A01.

See also PB—89-102594. Portions of this document are not fully legible.

This background document explains the basis for regulations concerning discarded commercial products, which are described and listed in Section 261.33 and for which exclusion levels are established in Section 261.5. Commercial chemical products or manufacturing chemical intermediates are divided into two categories: those that are acutely hazardous and subject to stringent exclusion levels; and those that are hazardous wastes. These regulations concern commercial chemical products, and associated off-specification chemical products, spill-cleanup residues, and debris. For acutely hazardous chemicals, the regulations also cover containers and inner liners that contain the acutely hazardous chemicals.

13064 **(PB—89-126478/XAB) Permit writers' guidance manual for hazardous-waste tanks. Draft report.** (Battelle Columbus Div., OH (USA)). 1988. 196p. NTIS, PC A09/MF A01.

The purpose of this manual is to provide a resource for permit writers in the implementation of Part 264, Subpart J, CFR, which sets forth regulations for facilities that use tanks to treat or store hazardous waste. The material is meant for guidance purposes only and is not meant to replace data and information specific to the facility being assessed. The manual was written primarily to assist permit writers when performing a technical review of Part B permit applications for facilities that treat or store hazardous waste in tanks and when writing the final permit. The most likely user would be either an engineer or a scientist with some experience in reviewing engineering information.

13065 **(PB—89-128235/XAB) Heat recovery from solids in industrial processes.** Saastamoinen, J.J. (Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Thermal Engineering). 1988. 88p. NTIS, PC E04/MF A01.

Heat recovery from solids in industrial heat-treatment processes is considered. There are two main ways to improve the energy efficiency and economy of the heating process. The waste energy can again be used in the process to preheat the cool input. Another possibility is to use the waste energy in a process requiring a lower-temperature level. Heat-recovery arrangements both for continuous and discontinuous processes are presented. The energy demand of a heating or a heat-treatment process (in metal, clay, glass, and food industries) can greatly be decreased by the heat recovery. New methods for the heat-treatment processes requiring much less energy are presented. Several heat-recovery arrangements are described, and analytical solutions for the efficiency of the heat recovery are presented.

13066 **(PB—89-128540/XAB) RCRA (Resource Conservation and Recovery Act) Facility Investigation (RFI) guidance.** (NUS Corp., Gaithersburg, MD (USA)). Jul 1987. 1024p. NTIS, PC E99/MF E99.

Set includes PB—89-128557 through PB—89-128581.

This four-volume report provides guidance to owners and operators of hazardous-waste-management facilities concerning the second phase of the EPA RCRA Corrective Action Program, viz., the RCRA Facility Investigation (RFI). Guidance is provided for conducting an RFI, based on pollutant-release determinations made by the regulatory agency, covering soil, surface water, ground water, subsurface water, and air. Volume I covers the rationale, general strategy, and procedures for developing a plan for conducting an RFI, and describes how data collecting in an RFI will be interpreted by the regulatory agency; Volumes II and III describe

media-specific methods for conducting an RFI; Volume IV presents case studies to illustrate various aspects of the RFI process.

13067 **(PB—89-128557/XAB) RCRA (Resource Conservation and Recovery Act) Facility Investigation (RFI) guidance. Volume 1. Development of an RFI work plan and general considerations for RCRA facility investigations. Draft report.** (NUS Corp., Gaithersburg, MD (USA)). Jul 1987. 270p. NTIS, PC A12/MF A01.

See also Volume 2, PB—89-128565; Also available in set of 4 reports PC E99, PB—89-128540.

This document, presented in four volumes, provides guidance to owners or operators of hazardous waste management facilities as to the conduct of the second phase of the RCRA Corrective Action Program, the RCRA Facility Investigation (RFI). The document provides such owners or operators with guidance on conducting a RFI, based on release determinations made by the regulatory agency. The owner or operator of a facility is notified, through an enforcement order or permit conditions, of those unit(s) and releases (known or suspected) that must be further investigated. Media of concern include: soil, ground water, subsurface gas, air, and surface water. Volume I presents the procedures and rationale that should be used to develop a work plan for conducting the investigation, a general strategy for release investigations, other aspects of the investigation, and the means by which the data collected during the RFI will be interpreted by the regulatory agency. Volumes II and III describe media-specific methods for conducting an RFI. Volume IV presents case study illustrations of various aspects of the RFI process.

13068 **(PB—89-128565/XAB) RCRA (Resource Conservation and Recovery Act) Facility Investigation (RFI) guidance. Volume 2. Soil, ground water, and subsurface gas releases. Draft report.** (NUS Corp., Gaithersburg, MD (USA)). Jul 1987. 289p. NTIS, PC A13/MF A01.

See also Volume 1, PB—89-128557 and Volume 3, PB—89-128573; Also available in set of 4 reports PC E99, PB—89-128540.

This document, presented in four volumes, is intended to assist Regional and State personnel in exercising the discretion conferred by regulation in developing requirements for the conduct of RCRA Facility Investigations pursuant to 40 CFR 264. Instruction is provided for the development and performance of an investigation based on determinations made by the regulatory agency as expressed in the schedule of a permit or in an enforcement order issued under HSWA Section 3008(h). The purpose of the RFI is to obtain information for fully characterizing the nature and extent of releases of hazardous waste or its constituents; this information will be used to determine whether interim corrective measures or a Corrective Measures Study will be necessary.

13069 **(PB—89-128573/XAB) RCRA (Resource Conservation and Recovery Act) Facility Investigation (RFI) guidance. Volume 3. Air and surface-water releases. Draft report.** (NUS Corp., Gaithersburg, MD (USA)). Jul 1987. 228p. NTIS, PC A11/MF A01.

See also Volume 2, PB—89-128565 and Volume 4, PB—89-128581; Also available in set of 4 reports PC E99, PB-128540.

This document, presented in four volumes, is intended to assist Regional and State personnel in exercising the discretion conferred by regulation in developing requirements for the conduct of RCRA Facility Investigations, pursuant to 40 CFR 264. Conformance with this guidance is expected to result in the development of RFIs that meet the regulatory standard of adequately detecting and characterizing the nature and extent of releases. The document is not a regulation, and should not be used as such. Regional and State personnel must exercise their discretion in using the guidance document as well as other relevant information, in determining whether an RFI meets the regulatory standard.

13070 **(PB—89-128581/XAB) RCRA (Resource Conservation and Recovery Act) Facility Investigation (RFI) guidance. Volume 4. Case study examples. Draft report.** (NUS Corp., Gaithersburg, MD (USA)). Jul 1987. 237p. NTIS, PC A11/MF A01.

See also Volume 3, PB—89-128573; Also available in set of 4 reports PC E99, PB—89-128540.

This document, presented in four volumes, provides guidance to owners or operators of hazardous waste management facilities as to the conduct of the second phase of the RCRA Corrective Action Program, the RCRA Facility Investigation (RFI). Volume IV of the RCRA Facility Investigation Guidance contains case studies selected to illustrate various concepts and procedures described in Volumes I, II, and III. These case studies are provided to explain, through example, how various tasks can be conducted during RFIs. The case studies also identify some of the potential problems that can occur if the RFI sampling and analytical problems are not carefully designed and executed. The case studies, however, should not be used as the primary source of guidance for RFI program design and conduct. Volumes I, II, and III should be consulted. Most of the case studies are based on actual sites. In some cases, existing data have been supplemented with hypothetical data to illustrate a particular point.

13071 **(PB—89-853063/XAB) Activated carbon. January 1987-December 1988 (Citations from the NTIS data base). Report for January 1987-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 84p. NTIS PC N01/MF N01.

Supersedes PB—88-855549.

This bibliography contains citations concerning the use of activated carbon for the treatment of sewage and industrial wastes. Topics include performance evaluations at specific sites, engineering studies, and regeneration techniques. Applications in sewage treatment, coal conversion, petrochemical, and various other industries are presented. Citations pertaining to air pollution control are excluded. (This updated bibliography contains 116 citations, 19 of which are new entries to the previous edition.)

13072 **(PNL—6784) Thermocatalytic conversion of food processing wastes: Topical report, FY 1988.** Baker, E.G.; Butner, R.S.; Sealock, L.J. Jr.; Elliott, D.C.; Neuenschwander, G.G. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1989. Contract AC06-76RL01830. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006396/JAW.

The efficient utilization of waste produced during food processing operations is a topic of growing importance to the industry. While incineration is an attractive option for wastes with relatively low ash and moisture contents (i.e., under about 50 wt % moisture), it is not suitable for wastes with high moisture contents. Cheese whey, brewer's spent grain, and fruit pomace are examples of food processing wastes that are generally too wet to burn efficiently and cleanly. Pacific Northwest Laboratory (PNL) is developing a thermocatalytic conversion process that can convert high-moisture wastes (up to 98 wt % moisture) to a medium-Btu fuel gas consisting primarily of methane and carbon dioxide. At the same time, the COD of these waste streams is reduced by 90% to 99%, Organic wastes are converted by thermocatalytic treatment at 350{degree}C to 400{degree}C and 3000 to 4000 psig. The process offers a relatively simple solution to waste treatment while providing net energy production from wastes containing as little as 2 wt % organic solids (this is equivalent to a COD of approximately 25,000 mg/L). This report describes continuous reactor system (CRS) experiments that have been conducted with food processing wastes. The purpose of the CRS experiments was to provide kinetic and catalyst lifetime data, which could not be obtained with the batch reactor tests. These data are needed for commercial scaleup of the process.

13073 **(TNO-HMT—88-101) A new printing ink distribution system for a relief printing rotary-press, operation and energy conservation. Demonstration project 263.** De Boer, J.; Van Deventer, H.C. (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). Mar 1988. 35p. (In Dutch). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756341/JAW.

The Apeldoorn based branch of the Division of Technology for Society TNO of the Netherlands Organisation for Applied Scientific Research has tested the new printing ink distribution system Civilox. The new system and the measured consequences are described with respect to energy conservation, quantity of mineral oil used in the ink, paper spoilage, ink-aerosol generation in the work-

ing area and the quality of the printed matter. Financial aspects are discussed too; payback period is estimated to be three years. Practical experience with Civilox, gained by three printing offices over a number of years, is reported. Because of the emphasis on the quality of the printed matter the described system has to compete with offset printing, despite the higher energy consumption and more difficult operation of the latter. 7 figs., 4 tabs., 2 apps.

13074 **Underground waste barrier structure.** Saha, A.J.; Grant, D.C. (to Dept. of Energy, Washington, DC). US Patent 4,778,628. 18 Oct 1988. Filed date 15 May 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a method for disposing of waste material comprising: (1) forming a recessed area within the earth; (2) lining the recessed area with a layer of zeolite; (3) lining the layer of zeolite with a layer of activated carbonaceous material to form a cavity of a size sufficient to hold at least one 55 gallon drum; (4) placing the waste material within the cavity; (5) forming a ceiling over the waste material of a layer of the zeolite on a layer of the activated carbonaceous material, the layers cojoining with the respective layers formed in steps (2) and (3) to form a closed container of the activated carbonaceous material inside a closed container of the zeolite; and (6) covering the ceiling with earth, whereby the layer of activated carbonaceous material removes organic material that may leave the waste material and prevents the organic material from fouling the zeolite.

13075 **Placement accuracy gauge for electrical components and method of using same.** Biggs, P.M.; Dancer, L.K.; Yerganian, S.S. (to Dept. of Energy, Washington, DC). US Patent 4,776,088. 11 Oct 1988. Filed date 12 Nov 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a placement accuracy gauge for checking the accuracy of a machine which positions discrete electrical components on printed circuit boards wherein the machine utilizes a positioning head for releasably gripping the components, the machine effecting movement of the components and printed circuit boards relative to one another both orthogonally and rotationally; the placement accuracy gauge comprising: a substrate of transparent material having grid lines thereon and being dimensioned substantially the same as one of the printed circuit boards processed by the machine, the substrate having a surface divided into first, second and third regions; the grid lines in the first region being positioned in circle divided into segments with each segment having a line therethrough corresponding to a non-standard angle of machine rotation, the grid lines in each segment being parallel and perpendicular to the selected angle line; the second region including an array of grid lines arranged in target areas with each target area including two orthogonal grid loines and two diagonal grid lines with all grid lines intersecting at a common point, the second region further including an array of fiducial points recognizable by the machine; the third region having a plurality of grid lines arranged orthogonally with respect to one another in a rectangular area; whereby when the placement accuracy gauge is placed in the machine and components are placed within the grid areas and held thereto by a layer of adhesive.

13076 **Process for removal of hydrogen halides or halogens from incinerator gas.** Huang, H.S.; Sather, N.F. (to Dept. of Energy, Washington, DC). US Patent 4,762,596. 9 Aug 1988. Filed date 21 Aug 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a process for reducing the level of one or more halogens and/or halogen acids in a combustion gas containing an organic pollutant, comprising the steps of: providing the combustion gas, providing an electrochemical cell having a negative electrode, and electrolyte, a positive electrode, and means for applying a voltage across the electrodes, and electrochemically reducing the amount of halogen and/or halogen acids in the combustion gas at a temperature above about 700°C by contacting the combustion gas with the negative electrode to form a halide ion for transfer through the electrolyte to the positive electrode.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 12865, 13062, 13071, 13074, 13076, 13579

13077 **(SAND—87-3146) The interconnection issues of utility-intertied photovoltaic systems.** Stevens, J. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 35p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006362/JAW.

For photovoltaics to realize its potential as a significant contributor to US energy requirements, photovoltaic systems must be capable of benign interconnections with existing electric utility systems. Technical questions have to be addressed in these interconnections, including such issues as how the photovoltaic system will respond to the dynamics of the utility system, and how it will impact the quality of the utility's voltage and power. The answers to these questions may impact the methods of using photovoltaics and the mode of deploying arrays, both of which will ultimately affect the value of the systems' energy. In an effort to understand these questions and their answers, the National Photovoltaic Program has amassed a significant data base concerning photovoltaic/utility interface issues. This research has created an understanding of the issues involving such an interface and has helped resolve any potential problems with it. This report discusses technical issues associated directly with the photovoltaic/utility interface. 20 refs., 12 figs., 6 tabs.

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 12814

13078 **(PNL-SA—15607) The practical aspects of conducting field monitoring studies: Lessons learned from working with the real world.** Parker, G.B. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 4p. (CONF-880814—13). NTIS, PC A02/MF A01. Order Number DE88015936/JAW.

From Summer study on energy efficiency in buildings; Pacific Grove, CA, USA (28 Aug 1988).

Researchers have learned a great deal about designing, staging, and carrying out simple and complex field monitoring studies to investigate how buildings behave. These studies include energy monitoring and metering, indoor air quality and ventilation measurements, site inspections (audits), occupant surveys, and retrofit/weatherization programs. This information is of considerable value to those persons responsible for designing, planning, and implementing field studies. This is particularly true for studies in the residential sector, although both residences and commercial buildings offer unique challenges in this area. Unfortunately, institutional and political barriers have prevented much of the practical information learned in field studies from being disseminated. The net results are new field monitoring studies that suffer from avoidable inefficiencies, frustrations, missed deadlines, excessive costs, and glaring mistakes. Less than desired data and data quality are common products of such a study. This workshop provided a forum for discussion of several key issues that arise during the design and conduct of field monitoring studies of buildings.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

REFER ALSO TO CITATION(S) 12582

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 13289, 13682

13079 **(AD-A—199951/5/XAB) Low-quality fuel problems with advanced-engine materials. Interim report, June-July 1987.** Jones, R.L. (Naval Research Lab., Washington, DC (USA)). 9 Aug 1988. 25p. (NRL-MR—6252). NTIS, PC A03/MF A01.

The ultrahigh-power, high-efficiency engines of the future will utilize advanced materials including ceramics, composites, and augmented metals. In many cases, these materials may be subject to corrosion by high-temperature gases and molten-salt deposits resulting from contaminants (e.g., sodium, sulfur, vanadium) in the fuel or engine air. This Memorandum Report gives a short overview of the state of knowledge that exists today concerning corrosion of ceramics and metals by fuel contaminants, and of possible new avenues for research and materials development. It was originally presented as the Keynote Paper for the Session on Hot-Corrosion, Combustion, and Emissions at the DOE-sponsored Coatings for Advanced Heat Engines Workshop, July 27-30, 1987, Castine, ME.

13080 **(PB—89-853048/XAB) Two-stroke engines. June 1970-December 1988 (Citations from the COMPENDEX data base). Report for June 1970-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 155p. NTIS PC N01/MF N01.

Supersedes PB—88-855580.

This bibliography contains citations concerning the operating characteristics, performance, and applications of two-stroke-cycle internal-combustion engines. Topics include fuel injection, lubrication, and exhaust systems as well as emission control. Marine, motorcycle, and diesel engines are included. Factors contributing to engine noise are also discussed. (This updated bibliography contains 350 citations, 182 of which are new entries to the previous edition.)

3303 Electric-powered Systems

13081 **(EGG-M—88341) Evaluation of state-of-charge indicator approaches for EVs.** Burke, A.F. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 11p. (CONF-880241—2). NTIS, PC A03 - OSTI. Order Number DE89005412/JAW.

From Society of Automotive Engineers international congress and exposition; Detroit, MI, USA (29 Feb 1988).

Studies of battery management systems (BMS), including state-of- charge (SOC) algorithms, were performed in the Battery Test and Vehicle Dynamometer Laboratories at the INEL. The test and evaluation of the SOC algorithms indicated that the capacity rate dependent and adaptive approaches to determining battery SOC yielded RMS errors between the indicated and actual states-of-charge of less than 10% if battery temperature and aging effects were not dominate. The BMS tested were not sufficiently accurate and reliable to permit their use as the primary means of charge control during the various INEL test programs. Considerable progress has been made in the development of BMS, but further work is needed before the systems can be used with confidence in either the charge or discharge modes without careful attention from the user. 10 refs., 9 figs., 3 tabs.

13082 **(EGG-M—88342) Comparison of simulation and test for electric vehicles of recent design.** Burke, A.F. (EG and G Idaho, Inc., Idaho Falls (USA)). [1988]. Contract AC07-76ID01570. 7p. (CONF-890240—1). NTIS, PC A02 - OSTI. Order Number DE89005409/JAW.

From International congress and exposition of the Society of Automotive Engineers, Inc.; Detroit, MI, USA (27 Feb 1989).

Comparisons have been made between data obtained from dynamometer tests of various electric vehicles and computer simulations of the same vehicle-battery combinations for several driving cycles. The vehicles included in the study were the ETV-1, Bedford Van, Unique Mobility, ETX-1 and DSEP(TB-1). The batteries studied were the ALCO 2200, Gel/cel 3, EV5T, ETX-100(CHL12), and the NIF-170. The comparisons indicated that the energy consumption values obtained using ELVEC agree within 10% with test data for both constant speed and variable power driving schedules. The range comparisons were less consistent, but the predictions agreed with the data to within 10% if the vehicle battery was in good condition and the controller did not limit battery power at low states-of-charge. Second-by-second comparisons of measured and calculated values of battery power and current during transient vehicle operation showed the agreement worse than would have been expected based on the good agreement found for cycle energy consumption. Further development of ELVEC is needed to complete its validation as an electric vehicle simulation code. 12 refs., 6 figs., 9 tabs.

13083 **(EGG-M—881162) Comparative performance evaluation of advanced AC and DC EV propulsion systems.** MacDowall, R.D.; Crumley, R.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 9p. (CONF-881162—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005419/JAW.

From 9. electric vehicle symposium; Toronto, Canada (13 Nov 1988).

Idaho National Engineering Laboratory (INEL) evaluates EV propulsion systems and components for the US Department of Energy (DOE) Electric and Hybrid Vehicle (EHV) Program. In this study, experimental data were used to evaluate the relative performances of the benchmark Chrysler/GE ETV-1 DC and the Ford/GE First Generation Single-Shaft AC (ETX-I) propulsion systems. Tests were conducted on the INEL's chassis dynamometer using identical aerodynamic and rolling resistance road-load coefficients and vehicle test weights. The results allowed a direct comparison of selected efficiency and performance characteristics for the two propulsion system technologies. The ETX-I AC system exhibited slightly lower system efficiency during constant speed testing than the ETV-1 DC propulsion system. 7 refs., 5 figs., 3 tabs.

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 13083

3307 Emission Control

REFER ALSO TO CITATION(S) 13268

13084 **(EGG-M—88392) Aircraft fuel tank foam drying volatile organic compounds (VOC) control system.** LaRue, D.M.; Stepan, I.E.; McGovern, M.C. (EG and G Idaho, Inc., Idaho Falls (USA)). 15 Aug 1988. Contract AC07-76ID01570. 15p. (CONF-880879—3). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005170/JAW.

From Process technology '88: the key to hazardous waste minimization; Sacramento, CA, USA (15 Aug 1988).

A study to determine the best method for volatile organic compound (VOC) emissions control for aircraft fuel tank foam drying operation was performed. At the completion of that assessment, the Air Force requested that Idaho National Engineering Laboratory (INEL) design a prototype fuel tank foam drying system. This paper describes the assessment and the prototype design and operation. Under existing plans, the prototype will be fabricated and tested during FY 1989. 4 figs.

13085 **(PB—89-118368/XAB) Continuous measurement of diesel particulate emissions.** Cha, S.; Black, F.; King, F. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). 1988. 9p. (EPA—600/J-88/161). NTIS, PC A02/MF A01.

Pub. in Jnl. of the Air Pollution Control Association, Vol. 38, No. 3, 252-257(Jul 1988).

Evaluation of emerging diesel-particulate emissions control technology will require analytical procedures capable of continuous measurement of transient organic and elemental carbon emissions. Procedures based on the flame ionization properties of organic carbon and the opacity or light extinction properties of elemental carbon are described. The instrumentation provided adequate time resolution to observe the transient concentrations associated with typical automobile driving patterns. Accuracy and precision are evaluated by comparing integrated average results to measurements, using classical gravimetric filtration techniques. Emissions from two diesel passenger cars with substantially different chemical compositions are examined. Mass-specific extinction coefficients are developed using the Beer-Lambert Law and a simplified linear model that proved adequate for particulate concentrations typical of diluted passenger-car exhaust.

13086 **(PB—89-124374/XAB) Investigation of analyzer problems in the measurement of NOx from methanol vehicles. Final report.** Gabele, P.A. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). Nov 1988. 22p. (EPA—600/3-88/040). NTIS, PC A03/MF A01.

This study investigated the extent and source of irregularities related to the measurement of NOx emissions from methanol cars. Corrective measures also were explored. It was observed that NOx chemiluminescent analyzers respond to methanol and formaldehyde after being exposed to high concentrations of methanol and formaldehyde over extended periods. This response can cause significant errors in the measurement of NOx from methanol cars that have inherently elevated concentrations of exhaust methanol and formaldehyde. The most effective way of eliminating the spurious response is to clean the analyzer's reaction chamber regularly when testing vehicles being operated on methanol fuels.

13087 **(PB—89-853519/XAB) Air pollution control equipment: catalytic converters. January 1983-December 1988 (Citations from the COMPENDEX data base). Report for January 1983-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 67p. NTIS PC N01/MF N01.

Supersedes PB—88-850029.

This bibliography contains citations concerning the use of catalytic converters for automotive emission control. The cracking of hydrocarbons and the removal of sulfur and nitrogen oxide are emphasized. The effects of elevated temperatures on the creep properties of stainless steels used in catalytic converters are also included. (This updated bibliography contains 108 citations, 23 of which are new entries to the previous edition.)

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 13079, 13086

35 ARMS CONTROL

13088 **(AD-A—200164/2/XAB) Report of the Defense Science Board Task Force Subgroup on strategic air defense (SDI Milestone Panel). Final report.** (Defense Science Board, Washington, DC (USA)). May 1988. 13p. NTIS, PC A03/MF A01.

Conclusions of the Defense Science Board's Strategic Defense Milestone Panel include; 1) In view of the technical, budgetary, political, and arms-control uncertainties surrounding the ballistic missile defense program, the Panel recommends planning a number of steps in the technical development and deployment of a system to meet the JCS requirements rather than a single major action. 2) From a development point of view, priority should be given to the sensors, processing and communications necessary to provide an adequate assessment of what is actually going on, the nature and extent of the attack, and the detection and tracking of boosters and reentry vehicles. This framework is needed whatever weapons are actually used, and the research, development, and experimentation required to provide it involves most of the critical technologies. This surveillance system should evolve as the supporting technology becomes available, allowing the inclusion of whatever weapons are available and wanted. This restructuring would help assure priority attention to critical technical problems despite budget uncertainties and 3) Deployment should be in steps, each of which should provide some capability and have some value in itself.

13089 **(CONF-8810249—2) Risk associated with the demilitarization of the United States chemical weapons stockpile.** Flanagan, G.F. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004795/JAW.

From Annual meeting of the Society for Risk Analysis; Washington, DC, USA (31 Oct 1988).

A programmatic Environmental Impact Statement was prepared to assess the environmental impact of destruction of the continental US stockpile of unitary lethal chemical agent and munitions. This report contains topics on: Program Disposal Alternative, Accident/Risk Analysis, Risk Measures, Uncertainties in Estimates of Impacts and Risks, Implementation of the Selection Methodology, and Examining the Identified Alternative for Each Site Inventory. 8 refs., 9 figs. (JL)

13090 **(LLNL—9005958) West German attitudes toward short-range nuclear force (SNF) modernization.** Zinner, P.E. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005958/JAW.

This brief paper summarizing West German attitudes towards short- range nuclear force (SNF) was prepared by Prof. Zinner at our request. It is based on numerous interviews which he conducted while residing in Germany this past summer, as well as on articles which he reviewed while there. What comes through quite clearly, and is confirmed by other channels, is that SNF modernization is gradually, but perhaps almost inevitably, moving to center stage in German national security considerations. There is a fear in many quarters that the United States will take important actions in this area without adequate consultation or forethought; a fear exacerbated by the events leading to the INF Treaty. Furthermore, it seems ever more likely that SNF modernization could become a focal point of internal debate within the FRG in which case political factors might well overwhelm any opportunity for pragmatic actions. This paper is part of a continuing program of studies funded by the Office of Arms Control/DP/DOE and conducted by D Division. 7 refs.

3501 Policy, Negotiations, And Legislation

REFER ALSO TO CITATION(S) 13467, 13473

13091 **(AD-A—200439/8/XAB) Soviet objective of war termination: limits and constraints. Master's thesis.** Pelkofski, J.A. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1988. 220p. NTIS, PC A10/MF A01.

This abstract discusses the objectives of war termination from the perspective of the Soviet Union. Specifically, considerations relating to the possibility of limited Soviet objectives for terminating a war are analyzed. A possible future war in Europe is the primary example; it is argued that the political and military dissolution of NATO and the decoupling of U.S. military power from the continent might be sufficient Soviet conditions for seeking war termination. The hypothesis that the USSR would prefer to fight a conventional war (and avoid nuclear weapons) is examined as is the Soviet need to maintain cohesion within the Warsaw Pact. It is concluded that the limits of conventional warfare and the constraints of alliance dynamics could interact in Soviet strategy to limit objectives for terminating a future war in Europe. An appendix supplements and contrasts the thesis text by reviewing Western views on war termination.

36 MATERIALS

REFER ALSO TO CITATION(S) 12994, 14100

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 12692, 12846, 13047, 13173, 13301, 13319, 13348, 13366, 13567, 13909, 13910, 13912, 13925, 13937, 13939, 13940, 13943, 13944, 13947, 13950, 13951, 13952, 13953, 13954, 14055

13092 **(AD-A—199958/0/XAB) Dispersion strengthening of high-temperature niobium alloys. Annual report, May 1987-May 1988.** Anton, D.L.; Snow, D.B.; Giamei, A.F. (United Technologies Research Center, East Hartford, CT (USA)). 31 May 1988. 46p. (UTRC/R—88-917437-2). NTIS, PC A03/MF A01.

Niobium-base alloys are very attractive as high-temperature materials for advanced gas turbine applications. After many conventional metallurgical approaches, a high-temperature creep-resist-

ant alloy has yet to be identified that will replace nickel-base superalloys. The best chance for obtaining high-temperature creep resistance in these alloys is through dispersion strengthening with a stable precipitate that is introduced through rapid solidification. This would result in a very fine dispersion of nonshearable precipitates that would not coarsen upon long-term exposure at temperatures in excess of 1200 C. A study was conducted here identify such a stable dispersion, fabricate alloys through a rapid solidification approach and characterize the coarsening of the resulting precipitates. A thermodynamic argument is presented to select candidate dispersions for evaluation.

13093 **(AD-A—200344/0/XAB) Radiation effects on rare earth permanent magnets. Master's thesis.** Luna, H.B. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1988. 94p. NTIS, PC A05/MF A01.

With continuing improvements in rare earth permanent magnet (REPM) technology, applications for their use are being discovered that were previously not possible. Two such applications for permanent magnets are in focusing elements for linear accelerators and ion sources, and in insertion devices (wigglers and undulators) used to produce synchrotron radiation. However, these magnetic transport elements are subjected to high radiation levels. Consequently, there is considerable interest in the United States and abroad to discover and quantify the effects of radiation on REPMs. Using the Lawrence Livermore National Laboratory (LLNL) 100-MeV Linac, four different samples of REPM were irradiated to one to two gigarads of exposed dose from a bremsstrahlung production target in an attempt to simulate the consequences of beam spills of a high energy primary electron beam. Of the samples irradiated, Sm_2Co_{17} proved to be the most resistant to gamma radiation. The electron transport code CYLTRAN of the Integrated Tiger Series (ITS), which is an electron and photon Monte Carlo simulation code, was used to determine the angular and energy spectra for both electrons and photons produced by the target used at the LLNL Linac.

13094 **(AECL—9111) Acoustic emission from zirconium alloys during mechanical and fracture testing.** Coleman, C.E. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Oct 1986. 26p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704985/JAW.

The application of acoustic emission during the mechanical and fracture testing of zirconium alloys is reviewed. Acoustic emission is successful in following delayed hydride cracking quantitatively. It is especially useful when great sensitivity is required. Application to fatigue, tensile deformation and stress corrosion cracking appears promising but requires more work to separate phenomena before it can be used quantitatively. This report is based on an invited review for the American Society of Non-Destructive Testing Handbook: Volume 5, Acoustic Emission Testing.

13095 **(CNEA-NT—10/87) Low dose irradiation growth in zirconium.** Fortis, A.M. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Dept. de Materiales; Buenos Aires Univ. (Argentina). Facultad de Ciencias Exactas y Naturales). 1987. 184p. (In Spanish). NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS. Order Number DE88704939/JAW.

Low dose neutron irradiation growth in textured and recrystallized zirconium, is studied, at the Candu Reactors Calandria temperature (340 K) and at 77 K. It was necessary to design and build 1: A facility to irradiate at high temperatures, which was installed in the Argentine Atomic Energy Commission's RA1 Reactor; 2: Devices to carry out thermal recoveries, and 3: Devices for 'in situ' measurements of dimensional changes. The first growth kinetics curves were obtained at 365 K and at 77 K in a cryostat under neutron fluxes of similar spectra. Irradiation growth experiments were made in zirconium doped with fissionable material (0,1 at %/sup 235/U). In this way an equivalent dose two orders of magnitude greater than the reactor's fast neutrons dose was obtained, significantly reducing the irradiation time. The specimens used were bimetallic couples, thus obtaining a great accuracy in the measurements. The results allow to determine that the dislocation loops are the main cause of irradiation growth in recrystallized zirconium. Furthermore, it is shown the importance of 'in situ' measurements as a way to avoid the effect that temperature changes have in the final growth measurement; since they can modify the residual stresses and the overconcentrations of defects. (M.E.L.).

13096 **(CNIC—00155) Investigation of diffusion between Al and Al-Li alloy.** Guan Puyuan. (China Nuclear Information Centre, Beijing, BJ). Feb 1988. 10p. (In Chinese). (SOF—202-0002). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705062/JAW.

The interdiffusion between core and cladding was investigated. Core material is Al-Li alloy and cladding material is Al-Mg/sub -Cu-Si/ alloy. The diffusion couple have coextruded and solution-heat-treated (520 deg C, 2h). It has been experimentally proved that the formation and growth of the diffusion layer forming in the side of the core and cladding depend upon the conditions of solution-heat-treatment, parameters of extrusion process and surface situations of the core billet and the cladding billet. The diffusion depth of Li in the cladding measured by ion probe and mass spectrograph is 0.16 mm and 0.25 mm, respectively. The diffusion coefficient of Li in the cladding is 1.6 x 10/sup -9/ cm/sup 2//s.

13097 **(CONF-880703—7) Polar Kerr-effect observation of perpendicular surface anisotropy for ultrathin ferromagnetic films: Fcc Fe/Cu(100).** Liu, C.; Moog, E.R.; Bader, S.D. (Argonne National Lab., IL (USA)). May 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005853/JAW.

From Joint INTERMAG: magnetism and magnetic materials conference; Vancouver, Canada (12 Jul 1988).

The theoretically predicted perpendicular surface anisotropy of ultrathin ferromagnetic Fe films has been confirmed using the magneto-optical Kerr effect. Polar and longitudinal Kerr-effect measurements have been performed in-situ on the same fcc Fe/Cu(100) films to study the dependence of the magnetic properties on film thickness and growth temperature conditions. Auxiliary LEED and Auger studies are used to characterize the structure and growth of the films. For films 1.2--5.9 monolayers (ML) thick grown at {approximately}100 K, for instance, square hysteresis-loop behavior in the polar Kerr effect confirmed the dominance of the perpendicular surface anisotropy. Examples are presented to document how the polar and longitudinal Kerr-effect signals evolve for films thicker than 6 ML due to the easy axis reorienting into the film plane. 14 refs., 4 figs.

13098 **(CONF-880705—11) Magnetic structure of cubic Tb/sub 0.3/Y/sub 0.7/Ag.** Gotaas, J.A.; Said, M.R.; Kouvel, J.S.; Brun, T.O. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 10p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005783/JAW.

From International conference on magnetism; Paris, France (25 Jul 1988).

Tb/sub 0.3/Y/sub 0.7/Ag undergoes a magnetic phase transition at {approximately}36 K to an antiferromagnetic structure which neutron diffraction has shown to have two components. A commensurate antiferromagnetic component is similar to the ($\pi\pi$0) structure found in TbAg, but with a correlation range of only 42{angstrom} at 4 K, while an incommensurate modulated component is like that found in HoAg, but with a finite correlation range of 290{angstrom}. 9 refs., 2 figs.

13099 **(CONF-880705—12) Rotational magnetic processes in a Type-II superconductor.** Liu, L.; Kouvel, J.S.; Brun, T.O. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 10p. NTIS, PC A03 - OSTI. Order Number DE89005801/JAW.

From International conference on magnetism; Paris, France (25 Jul 1988).

Magnetization-vector ({rvec M}) measurements were made on a disk of compacted Nb powder rotated in a fixed field {rvec H} at 4.2 K. {rvec M} is a separable into a non-rotating diamagnetic component (~ {minus}{rvec H}/4π for H < and even > H/sub c1/) plus a penetrating-flux component which (for H > H/sub c1/) rotates with the sample but only up to some critical angle, indicating a frictional torque due to flux pinning. 5 refs., 3 figs.

13100 **(CONF-881155—23) Phase stability of Ni_2Al_3 under electron irradiation.** Kenik, E.A.; Nastasi, M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400;W-7405-ENG-36. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004821/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

In-situ electron irradiations at 200, 300, and 1000 keV have been performed on Ni_2Al_3 at 100 and 300 K. At low doses, the Ni_2Al_3 partially disorders to a B2 structure with a lattice parameter of 0.284 nm, close to that extrapolated for β-NiAl at 60 at.% Al, the Ni_2Al_3 composition. The electron dose required to disorder the Ni_2Al_3 decreased with increasing accelerating voltage and possibly with decreasing temperature. At high doses, precipitation of aluminum from the B2 matrix occurs, along with radiation-induced sputtering and radiation-induced segregation. Lattice parameter changes for the B2 structure observed during irradiation are explained in terms of the compositional dependence of the lattice parameter of β-NiAl. The B2 structure remains stable to doses of 6 {times} 10^{28} electrons/m^2, with no amorphization detected. 17 refs., 4 figs.

13101 **(CONF-881155—24) Effect of preoxidation and grain size on ductility of a boron-doped Ni_3Al at elevated temperatures.** Takeyama, M.; Liu, C.T. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004803/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

The ductility of preoxidized Ni_3Al(Ni-23Al-0.5Hf-0.2B, at.%) specimens with various grain sizes (17 {approximately} 193 μm) was evaluated by means of tensile tests at 600 and 760{degree}C n vacuum. It was found that the preoxidation does not affect the ductility of the finest-grained material at either temperature, whereas it causes severe embrittlement in the largest-grained material especially at 760{degree}C. A continuous, thin Al-rich oxide layer, which forms on the fine-grained samples, protects the underlying alloy from oxygen penetration, preventing any loss of ductility, whereas the nickel-rich oxide which forms on the large-grained samples allows oxygen to penetrate along grain boundaries, causing severe embrittlement. The grain boundaries act as short-circuit paths for rapid diffusion of aluminum atoms from the bulk to the surfaces, and this is responsible for the difference in oxidation behavior between fine- and large-grained materials. The embrittlement of large-grained samples can be eliminated through control of oxide formation on Ni_3Al surfaces. 11 refs., 5 figs., 1 tab.

13102 **(CONF-881155—25) Microstructure and mechanical properties of $L1_2$-structure alloys based on Al_3Zr.** Schneibel, J.H.; Porter, W.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004802/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

The tetragonal compound Al_3Zr can be transformed into the cubic $L1_2$ structure by additions of Cr, Fe, Ni or Cu. This result is interpreted in terms of Pettifor's structure map. The transformation is accompanied by substantial softening. The significant porosity of cast buttons which develops during the homogenization required to produce the $L1_2$ structure is attributed to the Kirkendall effect. Al-5.5Fe-25Zr (at. %) specimens with $L1_2$ structure can be deformed at room temperature in compression, and their yield stress has been determined as a function of temperature. Al-Fe-Zr is nevertheless a brittle material. This is illustrated for an Al-Fe-V-Zr $L1_2$-structure compound, the fracture toughness of which is only slightly higher than that of sintered SiC. Evidence is presented to suggest that $L1_2$ formation is accompanied by an increase in toughness. It appears also likely that significant improvements in the mechanical properties of Al_3Zr-type alloys can be achieved by improved processing. 11 refs., 6 figs.

13103 **(CONF-8806145—2) Recent progress in understanding ion-beam mixing of metals.** Rehn, L.E.; Okamoto, P.R. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 33p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number TI89005834/JAW.

From 6. international conferene on ion beam modification of materials; Tokyo, Japan (12 Jun 1988).

Recent progress in three fundamental areas related to the ion-beam mixing of metal targets is reviewed: (1) molecular dynamics simulations of the temporal development of energetic displacement cascades; (2) the substantially increased mixing efficiencies that have been reported in many systems at intermediate irradiation temperatures; and (3) amorphization during ion irradiation. Significant advances in our fundamental understanding have occurred in all three of these areas in the past few years. Mass transport at various times during the evolution of energetic displacement cascades in Cu and Ni has been calculated recently using fully dynamic computer simulations. These results, discussed in section II, strongly support the conclusion drawn from earlier experimental work that a majority of ion-beam mixing occurs at low (1-2 eV) atomic recoil energies during the cascade cooling phase. In section III, characteristic differences are identified to freely-migrating vacancy and interstitial defects, and the enhanced ion-beam mixing that has been observed in many materials at intermediate temperatures. It is argued here that true radiation-enhanced diffusion should be observable only at substantially higher temperatures. Finally, recent measurements of the shear elastic constant, the lattice parameter, and the long-range order parameter during ion-induced amorphization of highly-ordered intermetallic compounds are summarized in section IV. This new information indicates that ion-induced amorphization is preceded by a first-order phase transformation triggered by an elastic instability, and reveals several parallels between solid-state melting and amorphization phenomena. 46 refs., 9 figs.

13104 **(CONF-8809107—2) Fundamental aspects of thin film corrosion in aqueous media.** Erdemir, A. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005874/JAW.

From Symposium on environmental degradation of ion and laser beam treated surfaces; Chicago, IL, USA (25 Sep 1988).

An in-depth understanding of the chemical and structural characteristics of ion-plated surface coatings is of critical importance, as these characteristics influence the mechanical, tribological and metallurgical performance of the resultant thin film-substrate systems. The mechanistic modelling of such film-substrate systems and the development of model systems for corrosion applications must take into account the fundamental aspects of thin films and underlying substrates (microstructure, morphology, thickness, chemistry, etc.) exposed to corrosive media. The present study deals with the electrochemical behavior of TiN film-steel substrate systems in acidic and saline test solutions. Results indicated that morphology, chemistry and thickness of thin films strongly affected the corrosion behavior of film-substrate systems. Sufficiently thick (about 2 μm) and structurally dense TiN films improved the corrosion resistance of underlying substrates by as much as 5 orders of magnitude. 27 refs., 12 figs.

13105 **(DOE/ER/45294—T2) Brittle-to-ductile transition in cleavage fracture: Progress report.** Argon, A.S. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Mechanical Engineering). [1989]. Contract FG02-87ER45294. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number TI89005737/JAW.

The basic direction of the research remains to be a dual approach combining an experimental investigation of the crack arrest temperatures in the cleavage fracture of samples of different crystal structure, with modeling of the crack tip dislocation emission process. The principal thesis is that a brittle cleavage to ductile behavior transition of fracture in intrinsically brittle solids is governed by crack tip processes that are controlled either by the energy barriers to the nucleation of dislocation loops from crack tips or the mobility of the nucleated dislocations away from the tip. It is anticipated that in a metallic material such as Fe 3% Si the process will be the former, while in Si it is already known that it is latter. The situation is unknown for intermetallic compounds such as Ni Ai which is also under investigation. In the remainder of this renewal proposal we start out by giving a brief progress report about both the experiments and the theoretical modeling research. This is followed by a brief program of proposed research.

13106 **(EWI—9005562) Field weldability of high strength pipeline steels: Final report.** Noble, D.N.; Pargeter, R.J. (Edison Welding Inst., Columbus, OH (USA)). 4 Mar 1988. 83p. American Gas Association, Order Processing Department, 1515 Wilson Boulevard, Arlington, VA 22209-2470. Order Number TI89005562/JAW.

This document reports on small scale weldability tests on two X80 grade steels and presents mechanical property data on full-size circumferential girth welds. This publication is available from the American Gas Association Order Processing Department, 1515 Wilson Boulevard, Arlington, Virginia 22209-2470 (703/841-8558). 6 refs. (JL)

13107 **(FRCEA-TH—156) Study of defects in GaAs and Zn Te semiconductors by electron paramagnetic resonance and by optically detected magnetic resonance.** Bittebierre, J. (Grenoble-1 Univ., 38 (France); CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). Apr 1987. 218p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88756673/JAW.

Electron paramagnetic resonance (EPR) and optically detected magnetic resonance (ODMR) studied the compensation processes that produce a semi-insulating state for the semiconductors GaAs and ZnTe under certain crystal growth conditions. The LEC-pBN gallium arsenide crystals studied are grown for use as semi-insulating substrates. EPR identifies the antisite As/sub Ga/ / sup +/ as being the principal defect responsible for compensating the majority acceptor impurity C/sub As//sup -/. The defect EL2 is identified as being an isolated As/sub Ga/ antisite and, in carbon rich crystals, pairs associating As/sub Ga//sup +/ and C/sub As//sup -/ are formed. This introduces levels in the bandgap between EL2 and E/sub c/, which explains the paradoxically high position of the Fermi level in carbon rich samples. New centres appear in infrared irradiation. Three of these centres, at least one of which has its ESR transitions induced by the electric field, are identified as acceptors. Their study provided an understanding of the complex phenomena that occur during infrared irradiation at 1.2 eV and provide proof that the metastable state of EL2 lies in the valence band. ODMR identifies two low symmetry acceptors in ZnTe, which are zinc vacancy - donor impurity pairs (V/sub Zn/ - D) having unquenched orbital momentum and intermediate depth. They contrast with the deep, strongly pseudo-Jahn-Teller distorted configurations observed for the same kind of V/sub Zn/ - D pairs in ZnS and ZnSe. The difficulty of obtaining n-type ZnTe is explained by the formation of these complex acceptors.

13108 **(FRNC-TH—3327) Study by electron transmission microscopy of defects induced by electrons and ions irradiation in pure zirconium and in four of its alloys.** Hellio, C. (Paris-11 Univ., 91 - Orsay (France)). Jul 1987. 164p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88754952/JAW.

Irradiation of alpha zirconium has for consequences an anisotropic deformation of the material. This effect gives an elongation for polycristalline fuel clads (for a fluence of 2.10/sup 25/ n.m/sup -2/ at 300/sup 0/C this deformation is in the order of 10/sup -3/). With the objective to a better knowledge of this growth under irradiation, we have analysed by electron transmission microscopy, the microstructure induced by Zr /sup +/ ion of 500 keV and 1 MeV electrons in pure zirconium alpha, in Zr/1760 ppm weight 0, in Zr/1 % weight Nb/430 ppm weight 0, in Zr/1 % weight Nb/1800 ppm weight 0 and in Zircaloy-4 (used in French PWR).

13109 **(GKSS—88/E/25) Neutronographic texture analysis of KTB-samples (ARGE 5).** Brokmeier, H.G.; Bunge, H.J. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Inst. fuer Metallkunde und Metallphysik). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1988. 7p. (CONF-8801136—). GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.).

From 1. KTB colloquium (Continental Deep Drilling Programme); Giessen, F.R. Germany (28 Jan 1988).

The complete orientation distribution of individual crystal axis can be calculated if several of their projections (pole figures) are known. This procedure is called ODF-analysis or pole figure inversion. The distribution functions of individual crystal direction can be determined by measurements of the axis directions of individual crystallites or the whole sample with X-ray, neutron or electron diffraction. Preliminary studies with texture diffractometer are described.

13110 (INIS-SU—63, pp 92-93) **Mechanical twinning criterium under local loading.** Bojko, V.S.; Krivenko, L.F. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01; INIS. Order Number DE89780044/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(44).

In Physics of radiation injuries and radiation materials technology. Scientific-technical collection.

Applicability of mechanical twinning criterium during zirconium microindentiation is shown. Expression for tau-bar in the material loaded by indentor is obtained analytically. Use of the expression for experimental data processing shows, that twins in zirconium occur at tau≈6.7x10 μ values (μ - shear module). Yield strength has the same order of magnitude at zirconium macrroscopic mechanical tests within low-temperatures range, when twinning contribution to plasticity is maximal. An attempt to use analogous approach to evaluate silicon ultimate strength is made by fracture data for.

13111 **(JAERI-M—88-176) Creep behavior of Ni-base heat resistant alloys for high temperature gas-cooled reactors in decarburizing helium environment.** Kurata, Yuji; Nakajima, Hajime; Ogawa, Yutaka. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Sep 1988. 24p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756575/JAW.

Creep and corrosion tests of Ni-base heat resistant alloys (Hastelloy XR and XR-II) for high temperature gas-cooled reactors (HTGR) were conducted at 950 deg C in several kinds of helium environments with different impurity compositions in order to examine the effect of decarburizing environment on creep behavior. Creep and corrosion data were analyzed on the basis of theoretical consideration in corrosion to clarify the corrosion mechanism in impure helium. Both alloys were decarburized in helium environment with low partial pressure of oxygen and carbon activity. The decarburization induced degradation of creep properties such as lower creep rupture strength, higher creep rate and earlier start of accelerating creep. Problems of the decarburization of the Hastelloy XR and XR-II in the primary helium coolant of HTGR could be predicted by using a stability diagram for chromium. Controlling impurities to maintain higher partial pressure of oxygen and carbon activity in primary coolant of HTGR is proposed in order to prevent degradation of creep properties of the materials caused by decarburization.

13112 (JINR—D-14-87-799, pp 49-53) **Investigation of heavy fermion systems by μSR. Evidence for weak magnetism.** Barth, S.; Ott, H.R.; Gygax, F.N.; Hitti, B.; Lippelt, E.; Schenck, A. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Magnetic properties of heavy fermion systems are investigated by μSR. The μSR results show unambiguously the presence of some complicated magnetic order and strong static correlations in CeAl/sub 3/ and U/sub 2/Zn/sub 17/ involving severely reduced effective moments below 10/sup -1/xμ/sub B/. Signs of weak magnetism seem to be present in all the heavy fermion systems, studied by μSR. The weak magnetism is a characteristic property which needs to be taken into account into a full theoretical description of these heavy fermion systems. 14 refs.; 3 figs.

13113 (JINR—D-14-87-799, pp 63-67) **Muon investigation of magnetic phase transformations in Fe/sub 56/Ni/sub 26/Cr/sub 18/ alloy.** Grebinnik, V.G.; Duginov, V.N.; Zhukov, V.A. and others. 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Magnetic phase transitions in Fe/sub 56/Ni/sub 26/Cr/sub 18/ alloy are investigated by muon method. Two subsequent phase transitions-P-F and F-SF- were observed for the first time using MSR method. Data on properties of a system with a three-phase state diagram near the ternary point are obtained. It is obtained that for P-F transition T/sub s/=(48+-2) K, and for F-SF transitions T/sub s/=(18+-2) K. 11 refs.; 2 figs.

13114 (JINR—D-14-87-799, pp 68-70) **Muon study of Fe/sub 70/Cr/sub 15/B/sub 15/ amorphous alloy.** Grebinnik, V.G.; Duginov, V.N.; Zhukov, V.A. and others. 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Amorphous Fe/sub 70/Cr/sub 15/B/sub 15/ alloy is investigated for the first time using the muon method. The sample investigated appears to be an amorphous band with 10 mm width and 20 μm thickness, its total weight making up 350 g. The band is twisted into spiral its plane being oriented in perpendicular to muon polarization direction. The experiment is conducted in a muon channel of a synchrocyclotron in Gatchina. As follows from the temperature dependences, the Λ(T) dependence has a peak at T {similar←to} 242 K corresponding to a phase transition from paramagnetic state to ferromagnetic one (Λ is the muon spin relaxation rate), i.e. to the phase transition of the 2nd type. 3 refs.; 2 figs.

13115 **(LA-UR—88-3861) Effects of B and S on Ni_3Al grain boundaries.** Voter, A.F.; Chen, S.P.; Albers, R.C.; Boring, A.M.; Hay, P.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-8809215—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003583/JAW.

From Atomistic modelling in materials - beyond pair potentials; Chicago, IL, USA (27 Sep 1988).

This report describes the procedure used to fit embedded atom style potentials to the pure elements Ni, Al, B and S and the cross potentials necessary for treating alloys and segregants. Grain boundary simulations, and results from molecular statics simulations using the potentials for B and S, and their cross potentials with Ni and Al, which was fit from electronic band structure calculations, are included. 21 refs., 1 fig., 3 tabs. (JL)

13116 **(LBL—25456) Characterization and applications of neutron transmutation doped germanium.** Park, I.S. (Lawrence Berkeley Lab., CA (USA)). May 1988. Contract AC03-76SF00098. 164p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004653/JAW.

Thermal neutron irradiation of germanium leads to gallium acceptors, arsenic and selenium donors, as well as radiation defects. Unlike other neutron transmutation doped (NTD) semiconductors in which only donor impurities are introduced, NTD germanium contains both types of dopant impurities in the ratio of acceptor:donor = 3:1. Radiation defects and the evolution of each impurity as a function of time in NTD germanium were investigated by Hall effect measurements and infrared absorption spectroscopy. The presence of radiation defects in an unannealed NTD germanium sample was clearly shown by measuring the net carrier concentration of annealed and unannealed samples as a function of time after neutron irradiation. Most of the radiation defects were removed by annealing above 400{degree}C for 1 hr. Using IR spectroscopy with bandage light illumination, it was shown that transmutation-produced gallium acceptors were electrically active without annealing after NTD, while arsenic donors were not. Further evidence showed that group V donors in irradiated germanium formed complexes with vacancies. These complexes were formed between substitutional donors and vacancies as shown by IR spectroscopy on neutron-irradiated, phosphorus-doped germanium. It was concluded that vacancies diffuse to the substitutional donor sites to form complexes. The possibility of the complex formation between interstitial donors (arsenic) and vacancies was not ruled out. Deep level defects in NTD germanium were studied after high temperature annealing (> 200{degree}C) by deep level transient spectroscopy. 118 refs., 56 figs., 7 tabs.

13117 **(PB—89-853444/XAB) Cutting fluids for grinding, milling, and machining of metals and minerals. December 1983-December 1989 (Citations from the COMPENDEX data base). Report for December 1983-December 1989.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 79p. NTIS PC N01/MF N01.

Supersedes PB—88-855275.

This bibliography contains citations concerning research, developments, and applications of cutting fluids/coolants for grinding, milling, and machining of metals and minerals. Tribological characteristics of cutting fluids, occupational health hazards, treatment of used coolants, and water jet cutting are included. Performance evaluations of various fluid compositions are examined. (This updated bibliography contains 153 citations, 17 of which are new entries to the previous edition.)

13118 **(SAND—86-2822) Barrier anodic coatings formed on 6061-T6 aluminum alloy in electrolytes containing different ethanol to water ratios.** Panitz, J.K.G.; Sharp, D.J.; Martinez, F.E.; Merrill, R.M.; Ward, K.J. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1988. Contract AC04-76DP00789. 27p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005505/JAW.

We have studied barrier anodic film formation on 6061-T6 aluminum alloy substrates as a function of electrolyte composition for five mixtures of ammonium tartrate dissolved in water and diluted with different amounts of ethanol. The effects of electrolyte temperatures within the range of 18{degree}C to 38{degree}C were explored. The results of this study indicate that the best dielectric coatings and the shortest processing times occur for the 100% water-ammonium tartrate electrolyte. The second best coatings and processing times occur in conjunction with the use of 98% ethanol, 2% water plus ammonium tartrate electrolyte. In general, visibly flawed coatings, scintillation events at cell voltages in excess of approximately 750-800 volts and/or abnormally long processing times occur in conjunction with the use of electrolyte mixtures containing 20%, 60%, and 90% water. We analysed samples of electrolyte as a function of usage, and evaluated the composition of the coatings using Fourier Transform Infrared Analysis to better understand the mechanisms which contribute to anodic coating growth that result in the observed variations in the dielectric properties. All of the coatings exhibited similar compositions except with regard to the amount of CO_2 that was physisorbed in the coatings. The dielectrically inferior coatings that were typically produced by the electrolytes containing ethanol contain substantially more CO_2 than the coatings grown in the 100% water-based electrolyte. These results strongly suggest that the ethanol in the electrolyte oxidizes and forms CO_2 which is incorporated in the coatings and results in inferior dielectric properties. 8 refs., 7 figs.

13119 **(SAND—88-2093C) Nanometer-scale shock-front structure in metals.** Taylor, P.A.; Dodson, B.W. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 15p. (CONF-881155—20). NTIS, PC A03 - OSTI. Order Number DE89004039/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Molecular dynamics shock wave simulations have been performed, which for the first time include a realistic many-body description of the atomic interactions. The structural instabilities observed in the shock-front structure are dramatically influenced by the many-body effects of these atomic interactions. 11 refs., 2 figs.

13120 **(UCRL—95940-Pt.2) Plating on molybdenum, Part 2.** Dini, J.W.; Beat, T.G. (Lawrence Livermore National Lab., CA (USA)). 21 Nov 1988. Contract W-7405-ENG-48. 18p. (CONF-8801133—1-Pt.2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004016/JAW.

From American Electroplaters Societies Foundation aerospace plating symposium; Orlando, FL, USA (25 Jan 1988).

Mo is difficult to coat with adherent films because its natural oxide, predominately MoO_3, interferes with the adherence of coatings. Many procedures have been reported in the literature for effectively coating Mo and one of the purposes of this paper is to highlight those providing the best results. Coatings applied by electroplating, physical vapor deposition (PVD), chemical vapor deposition (CVD) and plasma spraying will be covered. A second objective of this paper is to present some information on recent efforts with the procedure we use at our installation. 47 refs., 2 figs., 3 tabs.

13121 **(UCRL—99716-Rev.1) Reactive-element effect studied using ion implantation.** King, W.E.; Grabowski, K.S. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 53p. (CONF-880901—2-Rev.1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004774/JAW.

From Metallurgical Society fall meeting and American Society for Metals materials week; Chicago, IL, USA (24 Sep 1988).

Implantation of reactive elements into metals that form chromia layers upon exposure to high temperature oxidizing environments has a very large effect on the growth rate of the oxide and adhesion of the oxide to the base alloy. We have investigated the effect of Y ion implantation on the high temperature oxidation of Fe-24Cr using Rutherford backscattering spectroscopy, secondary ion mass spectroscopy, and electron microscopy. Analytical tools have been applied to determine the spatial distribution of Y, the microstructure of the oxide, and contribution of oxygen transport to the oxidation process. Results are compared with similar experiments in Fe-Cr alloys with Y additions and with results of cation and anion tracer diffusion experiments. 51 refs., 17 figs., 3 tabs.

13122 **(WIC—9005563) Heat-affected-zone toughness in heavy wall pipe: Final report.** Dyck, K.; Glover, A.G.; Varo, D.B. (Welding Inst. of Canada, Oakville, Ontario (Canada)). Feb 1988. 39p. American Gas Association, Order Processing Department, 1515 Wilson Boulevard, Arlington, VA 22209-2470. Order Number TI89005563/JAW.

The objective of this program has been to determine the significance of low toughness regions on the service performance of heat-affected zones in heavy wall pipe materials. The low temperature HAZ toughness of welds in microalloyed and quenched and tempered materials at two heat inputs was established, a test technique to produce fatigue cracks in the HAZ was developed, and four full scale fracture tests were completed at {minus}49{degree} F. Publication available from the American Gas Association Order Processing Department, 1515 Wilson Boulevard, Arlington, Virginia 22209-2470 (703/841-8558). 17 refs. (JL)

13123 **Dissolution of inert gas in a metal alloy.** Flinn, J.E.; Korth, G.E.; Wright, R.N.; Clark, D.E.; Loop, R.B. (to Dept. of Energy, Washington, DC). US Patent 4,768,577. 6 Sep 1988. Filed date 7 Oct 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a method of making a metal power comprising the steps of: providing a metal melt; atomizing the metal produce metal powder with inert gas entrained therein; and regulating the step of atomizing with respect concentration of the inert gas to introduce a beneficial level comprising a pre-selected level of atomic parts per million thereof entrained in the metal.

13124 **Combined atom-probe and electron microscopy characterization of fine scale structures in aged primary coolant pipe stainless steel.** Bentley, J.; Miller, M.K. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN (US));. pp v of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

The capabilities and complementary nature of atom probe field-ion microscopy (APFIM) and analytical electron microscopy (AEM) for the characterization of fine-scale microstructures are illustrated by examination of the changes that occur after long term thermal aging of cast CF 9 and CF 8M duplex stainless steels. In material aged at 300 or 400°C for up to 70,000 h, the ferrite had spinodally decomposed into a modulated fine-scaled interconnected network consisting of an iron-rich α phase and a chromium-enriched α' phase with periodicities of between 2 and 9 nm. G-phase precipitates 2 to 10 nm in diameter were also observed in the ferrite at concentrations of more than 10/sup 21/ m/sup -3/. The reported degradation in mechanical properties is most likely a consequence of the spinodal decomposition in the ferrite.

13125 **Accurate interatomic potentials for Ni, Al and Ni/sub 3/Al.** Voter, A.F.; Chen, S.P. (Theoretical Div., Los Alamos National Lab., Los Alamos, NM (US));. pp v of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

To obtain meaningful results from atomistic simulations of materials, the interatomic potentials must be capable of reproducing the thermodynamic properties of the system of interest. Pairwise potentials have known deficiencies that make them unsuitable for quantitative investigations of defective regions such as crack tips and free surfaces. Others have shown that including a local "volume" term for each atom gives the necessary many-body character without the severe computational dependence of explicit n-body potential terms. Using a similar approach, the authors have fit an interatomic potential to the Ni/sub 3/Al alloy system. This potential can treat diatomic Ni/sub 2/, diatomic Al/sub 2/, fcc Ni, fcc Al and L1/sub 2/ Ni/sub 3/Al on an equal footing. Details of the fitting procedure are presented, along with the calculation of some properties not included in the fit.

13126 **Synchrotron x-ray topography of dislocation arrays.** Bilello, J.C. (School of Engineering and Computer Science, California State Univ., Fullerton, Fullerton, CA (US));. pp v of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

The application of relatively low resolution x-ray topography methods, typically — 1 micrometer, is limited in studies which involve large scale dislocation networks. However, the ability to non-destructively image wide areas for "thick" specimens at high intensity with a tunable x-ray source makes the synchrotron an ideal probe for a range of problems previously inaccessible by other methods. Some examples are discussed such as: (a) crack initiation and propagation in fatigued bicrystals, (b) real-time in situ plastic deformation studies in strain-annealed Mo crystals, and (c) strain distributions in vapor deposited in LPE thin films on Si and GaAs substrates.

13127 **Nondestructive evaluation of tubing closure welds.** Rehbein, D.K.; Hsu, D.K.; Thompson, R.B.; Jones, T.A. (Ames Lab., Iowa State Univ., Ames, IA (US));. pp v of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Resistance tube closure welds, referred to as pinch welds, are used to reliably seal small stainless steel tubing. The quality of the bond is dependent upon, among other factors, the cleanliness of the tube bore. Post weld inspections are therefore desired as process control procedures. In previous studies, ultrasonics was shown to have considerable promise in this application. Others demonstrated that pattern recognition algorithms could be applied to the ultrasonic signals transmitted through the tubes to produce a correct classification of good and bad welds in several different sets of samples. The algorithms were somewhat dependent on the material from which the samples were fabricated, but all showed a good deal of commonality. In a parallel study, other authors examined, from a more mechanistic point of view, sets of tubes fabricated at the same time. They observed that gross disbonds could be easily detected from changes in signals either reflected from or transmit-

ted through the bond line. When such disbonds were not present, they observed that signals doubly transmitted through the interface (i.e., the back surface echo) showed a trend to lower values as the bond quality decreased. This paper describes the sequel to that study, having the objective of developing a quantitative understanding of the interaction of the ultrasound with the pinch welds.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 12550, 12836, 13056, 13117, 13157, 13171, 13248, 13263, 13285, 13451, 13926, 13942, 13945, 13946

13128 **(AD-A—199883/0/XAB) Effect of energetic-charged-particle bombardment on the properties of thin films of high-Tc superconductors. Final technical report.** Chrisey, D.B. (Naval Research Lab., Washington, DC (USA)). 1 Oct 1988. 30p. NTIS, PC A03/MF A01.

The effects of low-fluence (< 10^{14}/sq cm) 63-MeV H(+) and 65 MeV He_2^+ irradiation of prototype thin films of $YBa_2Cu_3O(7 - delta)$, produced by a plasma arc-spray technique are examined. The observed change in the resistance versus temperature behavior is much more dramatic than that observed for films produced by other techniques and resembles qualitatively a bond-percolation threshold. The radiation sensitivity of these plasma-arc spray films is concluded to be due to poor intergranular characteristics. This information is being used to modify the processing steps to improve the properties of films produced by this technique. In contrast, high-energy H- and He-ion irradiation of the laser-evaporated films resulted in a negligible change in the resistance-temperature behavior. The low-energy B and N ion irradiation of the laser-evaporated films had the effect of a gradual lowering of the completion temperature of the superconducting transition (T/sub C/ - completion). The gradual lowering of T/sub C/ - completion with fluence, d (delta T/sub c/) / d phi, with similar results by other groups. This behavior is interpreted as a progressive decoupling of the grains and extrinsic to that of the bulk $YBa_2Cu_3O(7-delta)$.

13129 **(AD-A—199959/8/XAB) New process for final densification of ceramics. Final report, 15 February 1985-14 May 1988.** Wagner, R.A. (Babcock and Wilcox Co., Lynchburg, VA (USA)). 14 May 1988. 67p. NTIS, PC A04/MF A01.

The objective of this program was to demonstrate the feasibility of novel densification process based on supercritical fluids. Using this process, carbon/carbon composites were impregnated with silicon carbide precursors and pyrolyzed to produce oxidation-resistant pore coatings. The resulting samples were characterized in terms of silicon distribution, mechanical properties, and oxidation resistance. The solubility behavior of candidate carbon and silicon carbide precursors was determined in supercritical propane and carbon dioxide. In addition, two silicon carbide precursors were fractionated and characterized to establish the molecular weight dependence of the char yield. The results of the solubility and fractionation studies were then used to guide the impregnation program.

13130 **(AD-A—199966/3/XAB) Effects of neutron irradiation on high-temperature superconductors. Master's thesis.** Hammerer, J.J. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1988. 60p. NTIS, PC A04/MF A01.

Neutron irradiation of high-temperature superconductors was performed in order to determine the effects of nuclear weapons on these novel materials. This radiation could also be encountered in space radiation belts, fusion reactors, and particle accelerators. Fluences used were on the order of 10^{18} fast and thermal neutrons/sq cm. The result of the irradiation was a complete loss of observed superconductivity in $YBa_2Cu_3O_7$ and $ErBa_2Cu_3O_7$. A combination of gamma heating of 5 W/g and fast-neutron-flux imposed serve thermal stress on sample pellets. In two cases, the pellets were reduced to powder. Samples were prepared at the Naval Research Laboratory and the National Research Laboratory and the National Bureau of Standards. They were checked for the Meissner effect using magnetic levitation. The dc four terminal method was used to determine the transition temperature.

13131 **(AD-A—200158/4/XAB) Fractal and spherulitic morphology of silicon nitride crystallized from amorphous films.** Kahn, A.D.; Grabowski, K.S.; Donovan, E.P.; Carosella, C.A.; Hubler, G.K. (Naval Research Lab., Washington, DC (USA)). 1988. 16p. NTIS, PC A03/MF A01.

Thin films of substoichiometric silicon nitride were grown by the use of ion beam assisted deposition. The amorphous films were annealed at high temperatures (1017-1200C) to produce crystalline alpha-Si_3N_4. Both highly symmetric spherulitic crystal morphologies and irregular fractal aggregates were seen. In the latter case, a fractal dimension of 1.2 was measured. These two macroscopically different forms possessed correspondingly different microstructures. The morphologies were found to be determined by the temperature of the anneal.

13132 **(AD-A—200202/0/XAB) Mechanistic studies of pressure-assisted superplasticity of structural ceramics. Scientific report, 15 June 1987-14 June 1988.** Chen, I.W. (Michigan Univ., Ann Arbor (USA)). 15 Jul 1988. 29p. (UMSC—88-C-AF-2). NTIS, PC A03/MF A01.

Superplastic flow in silicon nitride ceramics containing YAG was investigated. A low flow stress was found possible when the solid SIALON grains are included in the liquid-phase YAG above a critical temperature. The mechanisms of grain growth and microstructural development in silicon nitride and zirconia were studied. The effect of manganese addition on lowering the forming temperature of zirconia was demonstrated.

13133 **(AD-A—200360/6/XAB) Chemical processing of structural ceramics and composites. Final report, 15 July 1985-15 September 1988.** (Universal Energy Systems, Inc., Dayton, OH (USA)). Sep 1988. 88p. NTIS, PC A05/MF A01.

Chemical processing of ceramics has drawn considerable attention in recent years. This is mainly due to the realization that by controlling the structures, surfaces, and interfaces of materials at the molecular level, one can achieve high-performance ceramic components or devices, in the earliest stages of processing. Exploratory, experimental, and analytical investigations have been conducted on the following subjects through chemical processing: synthesis and application of organosilicon polymers, sol-gel processing of multi-component metal oxide systems, and chemical processing of high-temperature oxide superconductors. Summarized are major findings and the most recent and relevant additional results are also been included in this report. In addition to these, a number of publications have resulted from these investigations and are attached in the Appendix.

13134 **(AD-A—200536/1/XAB) Material constraints on electronic applications of oxide superconductors.** Braginski, A. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 1988. 7p. NTIS, PC A02/MF A01.

Pub. in Physics C, Vol. 153-155, 1598-1603(1988).

It is shown that oxide superconductor film surface and interface degradation represents the main obstacle to electronic applications. Surface-quality requirements imposed by passive components appear loss stringent than those necessary for functional tunnel junctions.

13135 **(CONF-880408—44) Atomic structure of tilt grain boundaries in NiO.** Merkle, K.L.; Smith, D.J. (Argonne National Lab., IL (USA); Arizona State Univ., Tempe (USA). Center for Solid State Science). May 1988. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005847/JAW.

From Spring meeting of the Materials Research Society; Reno, NV, United States (4 Apr 1988).

High-resolution electron microscopy at 400 kV has been used to study the core structure of large-angle <001> tilt grain boundaries in NiO. The deduced atomic structures show considerable variety and complexity, even for boundaries with the same tilt axis and misorientation. The coexistence of asymmetric and symmetric boundaries which is observed at each misorientation suggests that asymmetric grain boundaries containing densely packed planes

are associated with relatively low free energies. A multiplicity of core structures is found for the $\Sigma=5$ and the $\Sigma=13$ grain boundaries. The normal component of the rigid-body translation in these boundaries is quite small in view of the relatively open structure that is expected for grain boundaries in ionic solids. Substantial concentrations of Schottky pairs near the boundary cores, as well as relaxations parallel to the misorientation axis, are indicated. 11 refs., 7 figs.

13136 **(CONF-880845—2) Mossbauer effect studies of magnetism in superconducting systems.** Dunlap, B.D.; Kimball, C.W. (Argonne National Lab., IL (USA); Northern Illinois Univ., Dekalb (USA). Dept. of Physics). 1988. Contract W-31109-ENG-38. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005844/JAW.

From Meeting on nuclear methods in magnetism; Munich, F.R. Germany (1 Aug 1988).

The use of magnetism in the study of superconducting materials has gone from a time when the sole purpose was the introduction of magnetic ions for the specific purpose of degrading superconducting properties to a time when magnetic and superconductivity take comparable roles, with comparably sized interactions, in determining the overall properties of a material. Magnetic hyperfine measurements have been very useful, e.g., in sorting out values of exchange parameters, values of crystal field interactions, details of magnetic ordering, and spatial distribution of magnetism. As with most such measurements, Mossbauer data do not specifically provide a great deal of information on superconducting properties themselves, but they have provided an important complement to bulk property measurements such as heat capacity, susceptibility and magnetization, and have also been very important when taken together with neutron diffraction data on structural and magnetic properties. With the oxide superconductors, it seems clear that we may deal with rather complex magnetic phenomena, and it is clear that this type of research will continue to play an important part in developing our understanding of these phenomena. 87 refs., 6 figs.

13137 **(CONF-8809201—3) SIMS measurement of oxygen tracer diffusion in YBa_2Cu_3O/sub 7{minus}δ/.** Rothman, S.J.; Routbort, J.L.; Baker, J.E.; Nowicki, L.J.; Goretta, K.C.; Thompson, L.J.; Mundy, J.N. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38;AC02-76ER01198. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005884/JAW.

From American Institute of Mechanical Engineers meeting; Chicago, IL, USA (25 Sep 1988).

The present paper describes experiments to measure the tracer diffusion of ^{18}O in the high T/sub c/ superconductor YBa_2Cu_3O/sub 7-δ/, with special emphasis on depth profiling by secondary ion mass spectrometry (SIMS) and the analysis of the SIMS data. The tracer diffusion coefficients are given by an Arrhenius type expression: D* = (9 +- 8) {times} 10/sup {minus}6/ exp [{minus}(0.89 +- 0.05 eV)/kT] cm^2/sup {minus}1/. These results are discussed in the framework of the theory of Bakker et al. 30 refs., 13 figs.

13138 **(CONF-8809219—1) Opposite extreme structural relaxation behaviour in glassformers; a Brillouin scattering study of B_2O_3 and Ca/sub 0.4/K/sub 0.6/ (NO_3)/sub 1.4/.** Grimsditch, M.; Torell, L.M. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003889/JAW.

From Workshop on dynamics of disordered materials; Grenoble, France (26 Sep 1988).

Brillouin scattering in B_2O_3 and Ca/sub 0.4/K/sub 0.6/ (NO_3)/sub 1.4/ shows that the two liquids may be taken as opposite extremes in a representation of the general behavior of structural relaxation in glass forming liquids. In B_2O_3, which is a typical network glassformer, transverse Brillouin modes are observed above the glass transition over the large temperature range $\Delta T \sim 800$ K, which is the widest range reported so far for shear waves in liquids. From the ability of B_2O_3 to support shear stresses it is concluded that the intermediate range order persists in the liquid state over the wide temperature range $\Delta T \sim 1.4$ T/sub g/. In case of Ca/sub 0.4/K/sub 0.6/(NO_3)/sub 1.4/, which represents a non-network ionic glassformer, transverse modes were only observed in the limited range $\Delta T \sim 0.4$ T/sub g/ in which their velocity drastically decreased. The observation reflects the rapid collapse of the structure with increase in temperature typical for liquids which are weakly bonded. It is also supported by the finding that in the non-network Ca/sub 0.4/K/sub 0.6/(NO_3)/sub 1.4/ system, longitudinal structural relaxation processes become fast enough to be observed by Brillouin scattering already at temperatures {approximately} 1.5 T/sub g/, while in the network glassformer B_2O_3 structural relaxation is still not observed at a temperature of 2.4 T/sub g/. The average shear relaxation times were obtained in the wide time range (10^{-9} s - 1 s) from the shifts of the transverse modes. In an Arrhenius plot of the relaxation times, the data of the two liquids fall close to the opposite curves for relaxation behavior. The structural differences of the two systems are discussed in terms of some characteristics of the relaxation time such as its non-Arrhenius temperature dependence and its non-exponential time dependence. 30 refs., 11 figs.

13139 **(DOE/ER/45174—T1) [Rapidly solidified oxide superconductors]: Progress report, July 1, 1988--December 31, 1988.** O'Handley, R.C.; Kalonji, G. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). 1988. Contract FG02-84ER45174. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006323/JAW.

Superconductivity has been studied in the following systems: Gd/sub 1+x/Ba/sub 2-x/Cu_3O/sub 7-δ/, and $Bi_2Sr_2Ca_1O_8$. Crystal structure and phase diagrams are addressed. 3 figs., 1 tab. (CBS)

13140 **(DOE/FTR—9004733) [Visit laboratories, University of Milan, collaborative research on transition metal hydrides, University of Bologna, collaborative discussions and CNR Center, Milan, Bologna, and Rome, Italy, October 1, 1987--October 15, 1987]: Foreign trip report.** Koetzle, T.F. (Brookhaven National Lab., Upton, NY (USA)). 28 Oct 1987. Contract AC02-76CH00016. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004733/JAW.

Traveller visited the laboratory of Professor Alberto Albinati, Institute of Pharmaceutical Chemistry, University of Milan, to take part in a NATO-sponsored collaborative research project on structural studies of transition metal hydrides. Under the terms of this collaboration, neutron diffraction studies are carried out at the BNL High Flux Beam Reactor, while sample preparation and x-ray diffraction studies are carried out in Milan. Traveller brought with him to Milan a set of neutron diffraction data on an iridium complex which had been collected during a previously completed HFBR run, structure refinement calculations were initiated with these data, and plans were made for an upcoming visit of Professor Albinati to Brookhaven in November, 1987. Traveller also visited the laboratory of professor Dario Braga, Department of Chemistry, University of Bologna, to discuss collaborative studies of the influence of thermal motion and electron charge density distributions on the crystal structures of transition metal carbonyl cluster compounds; and he gave an invited lecture at the Institute of Structural Chemistry, CNR Center, Monterotondo, Rome, in which he described significant recent studies results of the Brookhaven research program on structures of transition metal hydrides and related organometallic compounds. The Italian laboratories visited by the traveller are among the world's leaders in organometallic structural chemistry, and these visits gave him the opportunity to learn of exciting new developments in this field, which is relevant to both catalysis and hydrogen storage.

13141 **(LA-UR—88-4038) Radiation induced amorphization in $YBa_2Cu_3O_7$ and $GdBa_2Cu_3O_7$ superconductors.** Parkin, D.M.; Nastasi, M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-881155—34). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005451/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

The response of $YBa_2Cu_3O_7$ and $GdBa_2Cu_3O_7$ high temperature superconductors to particle irradiation is examined. Both ion and electron irradiations have been shown to first produce an orthorhombic-to-tetragonal transformation at doses roughly a factor of

10 higher. Analysis of the displacement stoichiometry that results from 120, 300, and 1000 keV electron irradiations, 400 and 500 keV O irradiations, and 300 keV helium irradiations indicate that the orthorhombic-to-tetragonal transformation is driven by O atoms displacements either alone or in the presence of metal atom displacements and that the transformation to the amorphous phase is driven by displacements on the Y, Gd, or other rare earth atom site. 10 refs., 3 figs., 1 tab.

13142 **(N—89-11913) Adhesion, friction, and wear of plasma-deposited thin silicon nitride films at temperatures to 700 C.** Miyoshi, K.; Pouch, J.J.; Alterovitz, S.A.; Pantic, D.M.; Johnson, G.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. 12p. (NASA-TM—101377; E—4431; NAS—1.15:101377; CONF-8904103—). NTIS, PC A03/MF A01.

From International conference on wear of materials; Denver, CO, USA (9 Apr 1989).

The adhesion, friction, and wear behavior of silicon nitride films deposited by low- and high-frequency plasmas (30 kHz and 13.56 MHz) at various temperatures to 700 C in vacuum were examined. The results of the investigation indicated that the Si/N ratios were much greater for the films deposited at 13.56 MHz than for those deposited at 30 kHz. Amorphous silicon was present in both low- and high-frequency plasma-deposited silicon nitride films. However, more amorphous silicon occurred in the films deposited at 13.56 MHz than in those deposited at 30 kHz. Temperature significantly influenced adhesion, friction, and wear of the silicon nitride films. Wear occurred in the contact area at high temperature. The wear correlated with the increase in adhesion and friction for the low- and high-frequency plasma-deposited films above 600 and 500 C, respectively. The low- and high-frequency plasma-deposited thin silicon nitride films exhibited a capability for lubrication (low adhesion and friction) in vacuum at temperatures to 500 and 400 C, respectively.

13143 **(N—89-12746) Slurry-pressing consolidation of silicon nitride.** Sanders, W.A.; Kiser, J.D.; Freedman, M.R. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Nov 1988. 19p. (NASA-TM—101365; E—4352; NAS—1.15:101365). NTIS, PC A03/MF A01.

A baseline slurry-pressing method for a silicon nitride material is developed. The Si_3N_4 composition contained 5.8 wt percent SiO_2 and 6.4 wt percent Y_2O_3. Slurry-pressing variables included volume percent solids, application of ultrasonic energy, and pH. Twenty vol percent slurry-pressed material was approximately 11 percent stronger than both 30 vol percent slurry-pressed and dry-pressed materials. The Student's t-test showed the difference to be significant at the 99 percent confidence level. Twenty volume percent (300 h) slurry-pressed test bars exhibited strengths as high as 980 MPa. Large, columnar beta-Si_3N_4 grains caused failure in the highest strength specimens. The improved strength correlated with better structural uniformity as determined by radiography, optical microscopy, and image analysis.

13144 **(PB—89-852511/XAB) Ceramic bearings. January 1974-December 1987 (Citations from the International Aerospace Abstracts data base). Report for January 1974-December 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 167p. NTIS PC N01/MF N01.

See also PB—89-852529; U.S. sales only.

This bibliography contains citations concerning the manufacturing techniques and applications of ceramic bearings. Topics include a discussion of materials, such as silicon nitride, and ceramic bearings in high-speed and high-temperature applications. An analysis of surface-hardening techniques for wear and fatigue resistance is also included. (This updated bibliography contains 389 citations, none of which are new entries to the previous edition.)

13145 **(PB—89-852529/XAB) Ceramic bearings. January 1988-December 1988 (Citations from the International Aerospace Abstracts data base). Report for January 1988-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 44p. NTIS PC N01/MF N01.

Supersedes PB—88-854708. See also PB—89-852511; U.S. sales only.

This bibliography contains citations concerning the manufacturing techniques and applications of ceramic bearings. Topics include a discussion of materials, such as silicon nitride, and ceramic bearings in high-speed and high-temperature applications. An analysis of surface-hardening techniques for wear and fatigue resistance is also included. (This updated bibliography contains 87 citations, all of which are new entries to the previous edition.)

13146 **(PB—89-853154/XAB) SIALON (Si--Al--O--N) ceramics. January 1975-December 1988 (Citations from the International Aerospace Abstracts data base). Report for January 1975-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 89p. NTIS PC N01/MF N01.

Supersedes PB—88-850565; U.S. sales only.

This bibliography contains citations concerning the properties, preparation, fabrication, testing, and applications of SIALON (Si--Al--O--N, the constituents) ceramics. Applications include utilization in gas-turbine components, cutting tools, heat exchangers, and other high-temperature/high-stress components. Sintering methods and materials and microstructural analyses are discussed. (This updated bibliography contains 190 citations, 78 of which are new entries to the previous edition.)

13147 **Method for hot pressing beryllium oxide articles.** Ballard, A.H.; Godfrey, T.G. Jr.; Mowery, E.H. (to Dept. of Energy, Washington, DC). US Patent 4,762,656. 9 Aug 1988. Filed date 10 Oct 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a method for preparing an article of beryllium oxide by hot pressing comprising the steps of forming a homogeneous mixture of about 98.5 to 99.5 weight percent of beryllium oxide particulates and sufficient lithium hydroxide in an aqueous solution to provide about 0.25 to 1.5 weight percent equivalent of lithium oxide, contacting the mixture with carbon dioxide for a sufficient duration to convert in situ essentially all the lithium hydroxide to lithium carbonate, and thereafter hot pressing the mixture into an article of desired configuration of near theoretical density. The hot pressing step being characterized by the lithium carbonate being uniformly dispersed throughout the mixture and affixed to the beryllium oxide particulates and converting to lithium oxide during the hot pressing step to provide essentially uniform sintering of the beryllium oxide particulates for providing the article with essentially uniform density.

13148 **High temperature studies of stoichiometric cerium dioxide.** Faber, J. Jr.; Hitterman, R.L. (Argonne National Lab., Materials Science Div., Argonne, IL (US));. pp v of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

High-resolution, neutron time-of-flight Bragg scattering measurements have been carried out on polycrystalline CeO/sub 2/ as a function of temperature (20<T<1200C). Systematic deviations between theory and experiment for the integrated intensities of the Bragg reflections were observed; these deviations increased with increasing temperature. The deviations result from cubic anharmonic interactions that appear only on the oxygen sublattice. The results are discussed in terms of higher order cumulant tensor representations. The authors observe that these anharmonic interactions exhibit the same symmetry as those associated with defects incorporated into the fluorite lattice when CeO/sub 2/ is made nonstoichiometric.

13149 **Theoretical studies of defects in binary and ternary oxides.** Ching, W.Y.; Ellis, D.E.; Lam, D.J. (Physics Dept., Univ. of Missouri-Kansas City, Kansas City, MO (US));. pp v of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

In the past decade, there has been an explosive development of computational techniques utilizing high-speed computers to

study the electronic and atomic structural properties of solids. These techniques form an important compliment to laboratory experiments for providing a better understanding of spectroscopic properties, as well as the energetics of the solid systems. For ideal metallic and semiconducting crystal lattice with translational symmetry, the conventional energy band structure approaches are capable to provide a good degree of precision in both electronic structure and system energies. On the other hand the molecular-cluster model represents a convenient method of studying those properties that are primarily a function of the local environment of the system, such as vacancy, substitutional and interstitial defects. In this paper, the authors present some preliminary results of electronic structure of substitutional defects and vacancy in binary and ternary cubic zirconium oxides obtained by the embedded molecular-cluster model calculation. The importance of electronic charge redistribution in the solids where the defect is introduced into the perfect lattice is highlighted and the effect of electron polarization of the surrounding ions of the defect is discussed.

13150 **Imaging of dislocations and sub-grain boundaries in alumina through chromia - Vacancy and molybdenum solute atmospheres.** Raman, S.V. (Brookhaven National Lab., Upton, NY (US));. pp v of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

The phenomenon of plastic flow in alumina was previously characterized using sintering models and transmission electron microscopy. Some of the findings of the work were (a) near equality in the activation energy for volume diffusion and surface area reduction (82 kJ/mol), (b) a higher activation energy (440 kJ/mol) for Coble creep mechanism in the absence of gamma/alpha phase transformation and a lower activation energy (250 kJ/mol) when phase transformation was a part of the sintering process and, (c) presence of extended dislocations and deformed electron diffraction spots. In view of these results it was of interest to follow the effect of solute addition on plastic flow. The solutes were incorporated in alumina through gel synthesis route and formed solid-solution systems of Cr/sub 2/O/sub 3/ - Al/sub 2/O/sub 3/ and MoO/sub 3/ - Al/sub 2/O/sub 3/ at 1000°C. In the course of sintering there is partial vaporization of chromia and reduction of MoO/sub 3/. The chromia-vacancy and Mo metal thus impart an impurity decoration to the lattice. The scanning electron micrographs seem to show that they are segregated along grain boundaries, sub-grain boundaries and dislocations. With increase in temperature the linear vacancy segregations and the scattered vacancy clusters annihilate to form pores. These pores transform to creep cavities that extend from grain boundary to volume. The clustered occurrence of Mo at grain boundaries and its extended spacing in the sub-grain boundary is perhaps indicative of a dislocation pipe model for its segregation. On the basis of these modeling and microstructural results a heuristic argument is presented in favor of kinetic equality among self diffusion, dislocation pipe diffusion and dislocation climb, and in favor of the commencement of Coble and Nabarro-Herring creep with severance of these equalities.

13151 **HREM of grain boundaries in oxides.** Merkle, K.L. (Materials Science Div., Argonne National Lab., Argonne, IL (US));. pp v of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Recent progress in the understanding of the atomic structure of grain boundaries in ionic solids is briefly reviewed with emphasis on the application of the HREM technique to observations of tilt grain boundaries in NiO. The new generation of high-resolution electron microscopes which are capable of a point-to-point resolution of better than 2 A have allowed atomic-scale observations that can be directly compared to theoretical grain boundary models. Agreements and differences between theory and experiment are discussed. The importance and significance of faceting and asymmetrical boundaries is pointed out.

13152 **Small-angle scattering from disordered systems.** Schaefer, D.W. (Div. 1152, Sandia National Labs., Albuquerque, NM (US));. pp v of Scattering, deformation, and fracture in polymers. Wignall, G.D.; Crist, B.; Russell, T.D.; Thomas, E.L. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

A general discussion of scattering from disordered materials is presented. The parameters which characterize structure are illustrated in real-space and are also identified in the reciprocal-space profile measured in a scattering experiment. Scattering from fractal objects is described in detail. To illustrate the interpretation of scattering data, the growth and structure of fumed silica is discussed. The flame growth of silica is explained in terms of monomer-cluster ballistic polymerization in the early stages and diffusion-limited aerosol aggregation in the latter stages.

13153 **The temperature dependence of ion beam mixing of Zr on Al/sub 2/O/sub 3/.** Farlow, G.C.; Withrow, S.P.; Easton, D.S. (Wright State Univ., Dayton, OH (US));. pp v of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Three hundred angstrom Zr films were deposited on Al/sub 2/O/sub 3/ substrates and irradiated with 300 keV Xe ions to a dose of 1 x 10/sup 16/ /cm/sup 2/. The irradiation was carried out at 77 K, 300 K (ambient temperature), and 800 K. Changes in the deposited film and the Zr-Al/sub 2/O/sub 3/ interface were examined by comparing Rutherford backscattering spectra from irradiated and unirradiated regions of the samples. Ion beam induced reactions were observed at all three temperatures. The systematics of the temperature dependence of ion beam mixing are discussed.

3606 Other Materials

REFER ALSO TO CITATION(S) 12536, 12538, 12538, 12555, 1258 12652, 12773, 12773, 12774, 12774, 12775, 12911, 12911, 13029, 13056, 13066, 13129, 13133, 13271, 13276, 13331, 13350, 13351, 13354, 13355, 13521, 13522, 13523, 13913, 13914, 13917, 13918, 13938, 13949, 14042

13154 **(AD-A—199871/5/XAB) Analysis of thermal residual stress for metal-matrix composite with Al/SiC particles. Master's thesis.** Hur, S.H. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1988. 55p. NTIS, PC A04/MF A01.

When a metal-matrix composite is cooled down to room temperature from the fabrication or annealing temperature, residual stresses are induced in the composite due to the mismatch of the thermal-expansion coefficients between the matrix and fiber. A method can be derived for calculating the particles due to differences in thermal-expansion coefficients. Special attention is paid to creep deformation in the matrix phase. The analysis shows that considerable internal stresses and creep deformation appear in the composites when subjected to cooling.

13155 **(AD-A—199974/7/XAB) Photoreflectance study of boron-ion-implanted (100) cadmium telluride. Technical report.** Amirtharaj, P.M.; Odell, M.S.; Bowman, R.C.; Alt, R.L. (Aerospace Corp., El Segundo, CA (USA). Laboratory Operations). 3 Oct 1988. 23p. (TR—0088(3945-07)-1). NTIS, PC A03/MF A01.

Ion-implanted (100) cadmium telluride was studied, using the contactless technique of photoreflectance. The implantations were performed using 50- to 400-keV boron ions to a maximum dosage of 1.5 x 10^{16}/sq. cm, and the annealing was accomplished at 500C under vacuum. The spectral measurements were made at 77 K near the E_0 and E_1 critical points; all the spectra were computer-fitted to Aspnes' theory. The spectral line shapes from the ion-damaged, partially recovered and undamaged, or fully recovered regions could be identified, and the respective volume fraction of each phase was estimated.

13156 **(AD-A—199992/9/XAB) Tunable solid-state lasers and synthetic nonlinear materials. Final technical report, 1 August 1986-31 July 1987.** Byer, R.L. (Stanford Univ., CA (USA). Dept. of Applied Physics). 23 Sep 1987. 47p. NTIS, PC A03/MF A01.

The report, under Grant AFOSR-86-0275, contains five (5) sections: I) a list of equipment proposed and purchased under the grant, II) a discussion of exceptions to the original equipment list, III) a summary of research projects on which the equipment has been used, IV) a synopsis of the ongoing research activities of the Byer group, and V) a summary.

13157 **(AD-A—200131/1/XAB) New approach to understanding the semiconductor surface and interfaces.** Schultz, S. (California Univ., San Diego, La Jolla (USA). Dept. of Physics). 31 Oct 1988. 14p. NTIS, PC A03/MF A01.

Application of electron spin resonance was extended to the study of the silicon/metal interface to include gold, aluminum, and silver overlays. Representative data or presented for the observed broadening of the ESR linewidth for each of these metals applied to the silicon surface. The data show, whereas strong spin coupling was found for Au and Al (comparable to earlier results for Cu), no evidence was found of coupling for Ag. The author believes these differences illustrate the specificity of the silicon/metal atom bond at the interface, whose quantitative measure is one of the goals of this research. He is now in the process of completing the dedicated UHV in-situ ESR system that will enable desired measurements of the Si metal coupling to be made at the submonolayer coverage level. He has continued to search for ESR signals in the new high-Tc superconductors and to apply the low-field microwave-absorption technique for discovering new high-Tc materials. In particular, he improved the sensitivity of the technique such that he is readily able to detect superconductivity in single crystals as small as .000001 gm.

13158 **(AD-A—200147/7/XAB) Investigation of microstructural factors that cause low-fracture toughness in silicon carbide whisker/Al alloy composites. Annual report, 1 September 1987-30 September 1988.** Wawner, F.E.; Schueller, R.D. (Virginia Univ., Charlottesville (USA). Dept. of Materials Science). Oct 1988. 56p. (UVA—525398/MS89/103). NTIS, PC A04/MF A01.

This program deals with determining factors that influence strength, ductility, fracture toughness, and elongation to failure in silicon carbon whisker/aluminum alloy composites. Specifically, a microstructural study is being made in an attempt to define extrinsic and intrinsic factors that control fracture and thus influence properties. One of the more important products produced by ACMC from SiCw/Al composites has been the rolled sheet. The response of the material to secondary processing and thermo-mechanical treatment is of utmost importance with respect to material quality. The present study emphasizes microstructural-mechanical property characterization of the rolled material.

13159 **(AD-A—200162/6/XAB) Ion assisted deposition of fiber coatings for ceramic-matrix composites wth low-dielectric-loss tangents. Final report, 15 October 1987-15 October 1988.** (American Society for Engineering Education, Washington, DC). 15 Oct 1988. 35p. NTIS, PC A03/MF A01.

The preliminary goal of achieving facility in the growth and characterization of thin amorphous silver nitride films was reached without difficulty. Thermal-annealing studies resulted in the discovery of both bubble formation and crystallization in the film. This research can be divided into three segments. First is the fabrication of the amorphous films themselves. Second, the thermal stability of the films on various substrates would be investigated. Thirdly, the knowledge obtained about the structure and properties of the material would be utilized in understanding and further refining the science of thin-film deposition. These divisions were reflected finally in the preparation of three publications: Near Infrared Rugate Filter Fabrication by Ion Beam Assisted Deposition of Si(1-x) N(x) Films - The major emphasis of this paper is on the optical properties of the films; Stability of Silicon Nitride Coatings Produced by Ion Assisted Deposition; and Fractal and spherulitic Morphology of Silicon Nitride Crystallized from Amorphous Films.

13160 **(AD-A—200311/9/XAB) Optical-fiber science and technology: novel fibers and fiber sensors. Final report, 1 October 1986-29 February 1988.** Morse, T.F. (Brown Univ., Providence, RI (USA). Div. of Engineering). 29 Feb 1988. 5p. NTIS, PC A02/MF A01.

This equipment grant permitted purchase of a complete optical-fiber draw facility and auxilliary equipment for the fiber-characterization laboratory. The draw tower was erected in a specially prepared laboratory. It is a 7.8-m automated tower with a 20-kW carbon induction furnace, and sufficient room for two UV coating stages, or a UV coating stage and a thermal-curing stage. The tower installation took perhaps somewhat more time than initially anticipated, largely due to difficulties in the site preparation. The tower itself was installed on a reinforced-concrete pad, with appropriate vibration isolation. Experience was gained in the use of the tower, and kilometer lengths of fiber were drawn that range in diameter from 50 to 250 microns, with a tolerance of the order of a few microns. In anticipation of expanding the coating capabilities of the draw tower, a vacuum system was purchased for use with radio-frequency sputtering on-line on the tower. This will be particularly useful for ceramic-coated fibers in the study of the behavior of fiber-strengthened composite materials.

13161 **(AD-A—200409/1/XAB) Electron-irradiation-induced defects in Al(x)Ga(1-x)As. Final report, 1977-1988.** Summers, W.I. (Naval Academy, Annapolis, MD). 10 Jun 1988. 30p. (USNA-TSPR—155). NTIS, PC A03/MF A01.

This study analyzed two liquid-phase-epitaxy (LPE)-grown Al(x)Ga(1-x)As samples. One sample was electron irradiated with 1-MeV electrons, the other sample was non-irradiated. The goal of the study was to see the effect of the electron irradiation and characterize any trapping states encountered. Deep Level Transient Spectroscopy (DLTS) was used to analyze the samples. Only one was encountered in the non-irradiated sample, the so called DX center 1, while eight states were found in the irradiated smaple, including the DX center. From a discussion of the experimental results, it is concluded that the electron irradiation had no noticeable effect on the DX center, that the irradiation was responsible for the additional trapping states encountered in the irradiated sample, point defect modeling is accurate in characterizing the five of the seven irradiation-induced states. A summary of the DLTS trap parameters is given.

13162 **(AD-A—200463/8/XAB) Use of Rutherford backscattering and optical spectroscopy to study boron implantation in cadmium telluride. Technical report.** Jamieson, D.N.; Bowman, R.C.; Adams, P.M.; Knudsen, J.F.; Downing. R.G. (Aerospace Corp., El Segundo, CA (USA)). 3 Oct 1988. 21p. (TR—0088(3945-07)-2). NTIS, PC A03/MF A01.

The effect of large-dose boron implantation in single-crystal cadmium telluride (CdTe) was investigated by Rutherford backscattering spectrometry (RBS), with channeling double-crystal x-ray diffraction (DCD), and photoreflectance (PR) spectroscopy. Comparisons are made with the results of identical B implantations of silicon and gallium arsenides crystals. Multiple energy implantations were performed at room temperature and liquid nitrogen temperature with total doses up to 1.5 x 10^{16} B^+ ions/sq. cm. The implanted B distribution was measured with neutron depth profiling (NDP) and found to agree well with Monte Carlo ion-range calculations. The RBS results showed that the CdTe crystals had not been rendered completely amorphous even for the highest-dose implantation unlike GaAs and Si. Furthermore, the DCD results showed little implantation-induced structure in the rocking curves from the implanted CdTe crystals, in contrast to GaAs. The consequences of annealing at 500 C in an attempt to regrow the crystal structure are also discussed.

13163 **(AD-A—200531/2/XAB) Redistribution of dopant and impurity concentrations during the formation of uniform WSi_2 films by RTP.** Siegal, M.P.; Santiago, J.J. (Puerto Rico Univ., Rio Piedras). 1988. 6p. NTIS, PC A02/MF A01.

Pub. in Materials Research Society Symposium Proceedings, Vol. 100, 701-705(1988).

Secondary ion mass spectroscopy was used to study the effects of rapid thermal processing (RTP) on the formation of tetragonal tungsten disilicide thin films on Si(100), p-type 5 ohms/cm wafers. The substrates were chemically etched, followed by an RF sputter deposition of 710A tungsten metal. The samples were then fast radiatively processed in an RTP system for time intervals ranging from 15 to 45 seconds at high temperature (approx. 1100C) under high vacuum. The redistribution of the boron-dopant concentration profile is studied and shows that boron moves from the Si-substrate into the growing Tungsten Silicide film, eventually escaping into the vacuum. Oxygen is the major impurity in these samples and its removal from the interface was shown to improve the quality of the silicide film. Trace quantities of fluorine, chlorine, sodium, potassium, carbon and chromium were also detected.

13164 **(BMVG-FBWT—88-2) Determination of moisture diffusion in carbon fiber reinforced epoxy composites by means of radioisotope tracer technique.** Meier, H.; Boesche, D.; Zeitler, G.; Hecker, W.; Zimmerhackl, E.; Albrecht, W. (Bundesministerium der Verteidigung, Bonn (Germany, F.R.). Abt. Wehrtechnik; Staatliches Forschungsinstitut fuer Geochemie, Bamberg (Germany, F.R.)). 1988. 124p. (In German). Bundesministerium der Verteidigung, Bonn (Germany, F.R.). Dokumentations- und Fachinformationszentrum der Bundeswehr (DOKFIZBw).

The report describes results of an experimental study of moisture diffusion into carbon-epoxy composites by applying the radiotracer technique. Diffusion parameters and maximum moisture contents of carbon fibre reinforced plastics have been measured by using tritiated water as tracer in conjunction with profile sectioning technique and liquid scintillation counting. The data obtained by tracer technique can be used to calculate moisture absorption/desorption curves as a function of time for various relative humidities and temperatures, i.e., for accelerated environmental testing. In addition, general rules concerning the diffusion and moisture absorption of fibredux 914 C/913 C and fiberite 1076 composited have been elaborated. Furthermore, results of neutron induced autoradiography by the /sup 10/B(n,α)/sup 7/Li reaction points against a remarcable concentration of diffused water at the carbon/fibre/resin interface. (orig./AFK) With 9 refs., 11 tabs., 51 figs.

13165 **(CONF-880623—5) The intermediate-range order in molten and glassy $GeSe_2$.** Iyetomi, H.; Vashishta, P.; Kalia, R.K. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005855/JAW.

From 11. symposium on the reactivity of solids; Princeton, NJ, USA (19 Jun 1988).

The first sharp diffraction peak (FSDP) observed around 1 {angstrom}/sup {minus}1/ in the x-ray and neutron scattering experiments on the molten and vitreous $GeSe_2$ reflects existence of an intermediate-range correlation beyond the nearest-neighbor distances. The FSDP is also observed in other chalcogenide glasses, such as SiO_2, GeO_2, $SiSe_2$, and As_2Se_3. The origin of the FSDP, ranging from layerlike correlations to random packing of basic structural units, is thus the current point at issue. The purpose of the present paper is to provide a microscopic understanding of the physical nature of the intermediate-range order in terms of interatomic potentials. 18 refs., 7 figs.

13166 **(CONF-880623—6) Structural correlations and vibrational spectra of molten and glassy $GeSe_2$.** Vashishta, P.; Kalia, R.K.; Ebbsjoe, I. (Argonne National Lab., IL (USA)). Oct 1988. Contract W-31109-ENG-38. 36p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005861/JAW.

From 11. symposium on the reactivity of solids; Princeton, NJ, USA (19 Jun 1988).

Using an effective interionic interaction the properties of vitreous and molten $GeSe_2$ are investigated by molecular dynamics method (MD). The effective interaction includes steric repulsion. Coulomb interactions due to charge transfer, and charge-dipole interaction due to large electronic polarizability of anions. Calculations are carried out on systems consisting of 648- and 5184-particles. Results for partial pair distribution functions, static structure factors, distribution of bond angles, and vibrational density of states are calculated at various temperatures in the molten and glassy states. Short range order in both glassy and molten states is dominated by Ge(Se/sub 1/2/)$_4$ tetrahedra and Ge-Se, Se-Se and Ge-Ge bond lengths are found to be 2.35, 3.75 and 4.30 {angstrom}, respectively. The static structure factor exhibits the first sharp diffraction peak (FSDP), a characteristic of intermediate range order in chalcogenide glasses, as well as all the other peaks observed in x-ray and neutron diffraction measurements. 44 refs., 11 figs.

13167 **(CONF-880715—12) Surface enrichment in polymer blends: A neutron reflection test.** Composto, R.J.; Stein, R.S.; Kramer, E.J.; Jones, R.A.L.; Mansour, A.; Karim, A.; Felcher, G.P. (Argonne National Lab., IL (USA)). Jul 1988. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005877/JAW.

From 4. international conference on neutron scattering (ICNS '88); Grenoble, France (12 Jul 1988).

In polymer melts of protonated and deuterated polystyrene (PS and d-PS) surface segregation of the d-PS occurs at temperatures and compositions in the one phase region close to the coexistence curve for phase separation. A neutron reflection test on a polymer blend containing 10% volume fraction of d-PS has shown that a thermal treatment caused a surface enrichment of d-PS up to 28%. The experiment demonstrates that neutron reflection measurements can generate detailed information on surface enrichment phenomena in polymer blends.

13168 **(CONF-880726—5) Rings, intermediate-range order and vibrational spectra of chalcogenide glasses.** Vashishta, P.; Kalia, R.K.; Ebbsjoe, I. (Argonne National Lab., IL (USA)). Oct 1988. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005887/JAW.

From 4. international conference on structure of non-crystalline materials; Oxnard, CA, USA (18 Jul 1988).

Short-range order, intermediate-range order and vibrational density of states of vitreous $GeSe_2$ are investigated using the molecular dynamics (MD) method. The static structure factor exhibits the first sharp diffraction peak (FSDP), a characteristic of intermediate-range order in chalcogenide glasses, as well as all the other peaks observed in structural measurements. The anomalous dependence of the FSDP, i.e. the decrease in its height on cooling is due to frustration enhanced by the increased density. The calculated phonon density of states in the glass shows peaks at 8.0, 10.8, 26.4, 34.4, and 37.2 MeV, which are all in good agreement with neutron experiments. In addition a companion line, A/sub 1c/, to the symmetric breathing mode A_1 (26.4 MeV) is identified with a feature at 27.8 MeV. Raman studies also find A/sub 1c/ to be {approximately}1.5 MeV higher than the A_1 mode. Our calculations show that the A/sub 1c/ mode arises due to vibrations of tetrahedra belonging to 5- and 7-fold rings. 12 refs., 4 figs.

13169 **(CONF-880726—6) $SiSe_2$ glass: A molecular dynamics study.** Antonio, G.A.; Kalia, R.K.; Vashishta, P. (Argonne National Lab., IL (USA)). Oct 1988. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005881/JAW.

From 4. international conference on structure of non-crystalline materials; Oxnard, CA, USA (18 Jul 1988).

This report discusses the results of a molecular dynamics (MD) study of molten and glassy $SiSe_2$ using an effective interparticle interaction. Results for the partial pair-correlation functions, partial structure factors and bond-angle distributions are reported. Results are in good agreement with the neutron diffraction and inelastic scattering experiments.

13170 **(CONF-880726—7) HNC theory of medium-range order in glasses.** Iyetomi, Hiroshi; Vashishta, P.; Kalia, R.K. (Argonne National Lab., IL (USA)). Oct 1988. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005880/JAW.

From 4. international conference on structure of non-crystalline materials; Oxnard, CA, USA (18 Jul 1988).

The first sharp diffraction peak (FSDP) and its anomalous temperature dependence, characterizing medium-range order in molten and vitreous chalcogenides, are elucidated in terms of interatomic potentials using the integral-equation method. The systemat-

ic study of the size and charge-transfer effects in $GeSe_2$ shows that the rationale behind the FSDP is cooperation of the excluded volume effect and the local charge neutrality leading to the conditional packing of atoms with formation of the tetrahedra, Ge(Se/sub 1/2/)$_4$. The anomaly in the FSDP is ascribed to the increase of the number of density on cooling. 11 refs., 6 figs.

13171 **(DOE/ER/45320—2) Studies of III-V compounds in the megabar regime: Technical progress report.** Ruoff, A.L. (Cornell Univ., Ithaca, NY (USA)). [1988]. Contract FG02-87ER45320. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005722/JAW.

In this project we make systematic studies of the crystal structure changes of the III-V compounds as a function of pressure. The broad objective of the proposed research is to provide experimental data over a broad range of coordination number and interatomic spacing which can play a leading role in the testing and development of theoretical models of bonding. Phase transformations of GaAs, CeO_2, InSb are discussed. (CBS)

13172 **(ESA-CR(P)—2645-VOL-2) Development of fracture mechanics maps for composite materials (compression loading), volume 2. Final report.** Bergmann, H.W.; Schmidt, K.; Prinz, R.; Gaedke, M.; Hartung, W.; Schuetze, R.; Hillger, W.; Block, J.; Eggers, H.; Goetting, H.C. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Braunschweig (Germany, F.R.). Inst. fuer Strahlenantriebe). Apr 1988. 222p. (ETN—88-93175). NTIS, PC A10/MF A01.

The fracture behavior of fiber-reinforced composites in the compression loading regime was studied to gain understanding of failure phenomena. The response of test specimens under a broad range of material, loading and environmental parameters was investigated. By combining an evaluation of global laminate properties with an evaluation of micro- and macroscopic modes of failure, the understanding of the fracture and fatigue behavior of carbon fiber reinforced composites was enhanced. Responses of laminates containing delaminations; influence of thermal cycling on material properties; analytic considerations of damage mechanics; an analytical approach to delamination growth in multidirectional laminates; and time dependent behavior of laminates under multiple environmental conditions are described.

13173 (INIS-SU—63, pp 10-14) **Bivacancy formation in atom collision cascades at low-energy ion implantation into crystals.** Klimovich, B.V.; Nelaev, V.V. (Minskij Radiotekhnicheskij Inst. (Byelorussian SSR)). 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01; INIS. Order Number DE89780044/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(44).

In Physics of radiation injuries and radiation materials technology. Scientific-technical collection.

Analytical model for probability calculation of bivacancy athermal formation in atom collision cascades at impurities low-energy implantation with regard of ion and target atom masses difference is developed. Probability of bivacancy athermal formation in silicon and copper has maximal value at ion energies from 100 up to 40 eV and decreases with energy increase. Influence of mass of ions implanted in silicon is more essential for (100) and (111) directions. Probability calculations of bivacancy formation in silicon at argon and oxigen ions implantation by molecular dynamics method are carried out, and it confirms the analytical model basic aspects.

13174 **(JAERI-M—88-091) Evaluation of the optical efficiency of an 10 μm band optical fiber.** Haraguchi, Kazumi; Fukuda, Takeshi; Takahashi, Toranosuke; Yokomizo, Hideaki; Yoshida, Noriyuki. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). May 1988. 35p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756556/JAW.

Optical fiber for CO/sub 2/ laser beam is expected to be used as a flexible light guide for long distance propagation of interferometric or scattering measurement system. Cristallin silver bromide optical fiber has excellent transmission efficiency in the wide wavelength range of few microns to over ten microns. The test of transmission characteristics had been carried out for the trial silver bromide fibers of 0.35 mm and 0.7 mm core diameter.

13175 (JINR—D-14-87-799, pp 34-48) **Use of muon spin RF - resonance to investigate μ/sup +//μ reaction in condensed matter.** Nagamine, K.; Nishiyama, K. (Tokyo Univ. (Japan). Meson Science Lab.). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The usefulness of the spin resonance method for the probe of the varions types of reaction in condensed matter is demonstrated. The importance of the time-differential measurement is stressed. The same concept of the time-differential patterns can also be seen and used in varions types of the other magnetic resonances like muonium microwave resonance, laser resonance, level-crossing resonance, etc. The state of arts and future perspectives of the decoupling resonance method, under the light of probing μ/sup +//Mu chemical reactions in solids are described. 14 refs.; 8 figs.

13176 **(K/ETAC—61) Damage tolerance evaluation of PEEK [polyether ether ketone] composites: Final report.** Frazier, J.L. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 190p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005421/JAW.

A polyether ether ketone (PEEK) thermoplastic system is currently being evaluated in flight service as a structural element for the US Air Force C-130 transport plane. The particular structure under study is the C-130 belly skin, a fuselage panel that is located on the underside of the aircraft and is subjected to impact from runway debris. A current Air Force objective is to reduce maintenance and replacement requirements of aircraft using lightweight composite structures to replace or supplement existing metal alloy components. The incorporation of lighter weight composite structures would result in aircraft weight reductions, allowing greater range and fuel economy. The impact-damage susceptibility of composite structures often results in strain-limited application of composite materials where the mechanical properties' advantages over traditional metal alloys are not attained. Methods developed to enhance the damage tolerance of composite material systems should increase their potential uses in existing and future aircraft. A materials evaluation program was conducted to determine the possible benefits of interleaving thermoplastic film layers between the plies of a PEEK/graphite composite material system to produce a material system with increased resistance to impact damage. Several laminate designs incorporating PEEK thermoplastic film as an interleaf material were subjected to impacts of various energies and projectile velocities. Mechanical properties of unimpacted, open-hole, and impacted laminate panels were measured to determine the effectiveness of the interleaf concept for improving damage tolerance relative to the existing baseline material. 5 refs., 19 figs., 8 tabs.

13177 **(N—89-12237) Analysis of positron lifetime spectra in polymers.** Singh, J.J.; Mall, G.H.; Sprinkle, D.R. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Dec 1988. 61p. (NASA-TP—2853; L—16468; NAS—1.60:2853). NTIS, PC A04/MF A01.

A new procedure for analyzing multicomponent positron lifetime spectra in polymers was developed. It requires initial estimates of the lifetimes and the intensities of various components, which are readily obtainable by a standard spectrum stripping process. These initial estimates, after convolution with the timing system resolution function, are then used as the inputs for a nonlinear least squares analysis to compute the estimates that conform to a global error minimization criterion. The convolution integral uses the full experimental resolution function, in contrast to the previous studies where analytical approximations of it were utilized. These concepts were incorporated into a generalized Computer Program for Analyzing Positron Lifetime Spectra (PAPLS) in polymers. Its validity was tested using several artificially generated data sets. These data sets were also analyzed using the widely used POSITRONFIT program. In almost all cases, the PAPLS program gives closer fit to the input values. The new procedure was applied to the analysis of

several lifetime spectra measured in metal ion containing Epon-828 samples. The results are described.

13178 **(N—89-12745) Development of polyisocyanurate pour foam formulation for space shuttle external tank thermal protection system. Final technical report, March 1986-October 1987.** Harvey, J.A.; Butler, J.M.; Chartoff, R.P. (Dayton Univ., OH (USA)). Aug 1988. 49p. (NASA-CR—183511; NAS—1.26:183511; UDR-TR—88-96). NTIS, PC A03/MF A01.

Four commercially available polyisocyanurate polyurethane spray-foam insulation formulations are used to coat the external tank of the space shuttle. There are several problems associated with these formulations. For example, some do not perform well as pourable closeout/repair systems. Some do not perform well at cryogenic temperatures (poor adhesion to aluminum at liquid nitrogen temperatures). Their thermal stability at elevated temperatures is not adequate. A major defect in all the systems is the lack of detailed chemical information. The formulations are simply supplied to NASA and Martin Marietta, the primary contractor, as components; Part A (isocyanate) and Part B (poly(s) and additives). Because of the lack of chemical information the performance behavior data for the current system, NASA sought the development of a non-proprietary room temperature curable foam insulation. Requirements for the developed system were that it should exhibit equal or better thermal stability both at elevated and cryogenic temperatures with better adhesion to aluminum as compared to the current system. Several formulations were developed that met these requirements, i.e., thermal stability, good pourability, and good bonding to aluminum.

13179 **(NIPER—380) The thermodynamic properties of polycyclic aromatic oxygen-containing compounds: I, Chroman and isochroman: Topical report.** Chirico, R.D.; Archer, D.G.; Hossenlopp, I.A.; Nguyen, A.; Steele, W.V. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Dec 1988. Contract FC22-83FE60149. 31p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000709/JAW.

Measurements leading to the calculation of the ideal-gas thermodynamic properties for chroman and isochroman are reported. Thermomechanical and thermophysical properties were determined by adiabatic heat-capacity calorimetry, combustion calorimetry, comparative ebulliometry, and inclined-piston manometry. Density measurements are reported for chroman. Results were used to calculate entropies, enthalpies, and Gibbs energies of formation for the ideal-gas at selected temperatures from near the respective triple point temperatures to 500 K. Published estimates of the ideal-gas properties based on group-contribution estimates show large deviations from the experimental values reported here. 34 refs., 12 tabs.

13180 **(NP—9770228) Characterisation of transparent thermal insulation materials.** Pflueger, A.; Platzer, W.; Wittwer, V. (Fraunhofer-Institut fuer Solare Energiesysteme (ISE), Freiburg im Breisgau (Germany, F.R.)). [1988]. 31p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770228/JAW.

Transparent thermal insulation (TTI) has the job of protecting the absorber from energy losses while at the same time allowing the sunlight to pass through unhindered. A more detailed report is given of appropriate optimation experiments. First, the authors go into optical features such as transmission and reflection, absorption and thickness-dependency of the transmission and effective values. They then deal with the thermal properties of TTI (heat transmission coefficient, theory of equivalent conductivity, spectrum, filler gas). The studies show that transmission losses can be reduced to nil by opaque thermal insulation. Thus, TTI makes the external walls of a building into its heating system and compensates for ventilation losses. The radiation transmission depending on K of different materials is listed (including double glazing, aerogel in ferrous glass, polycarbonate honeycombs between glass and foil sheeting). Indications of the necessary material and technical improvements are given. (HWJ).

13181 **(ORNL/TM—10466) Fiber-reinforced ceramic tubular composites.** Caputo, A.J.; Lowden, R.A.; Moeller, H.H. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 55p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005683/JAW.

Ceramic fiber-ceramic matrix tubular composites have been developed in a joint program of Oak Ridge National Laboratory (ORNL) and the Babcock and Wilcox Company. This program was the first collaborative agreement between a private industry and ORNL. The ceramic tubular composites were fabricated using a novel chemical vapor infiltration process developed at ORNL. Silicon carbide filament-wound preforms were infiltrated with additional silicon carbide to form the matrix phase of the composite. The tubular composites exhibited exceptional strength and strain tolerances that were significantly higher than monolithic (nonreinforced) SiC. C-ring strengths and fracture surface evaluation of both room-temperature- and elevated-temperature-tested specimens are presented. 30 refs., 23 figs., 3 tabs.

13182 **(PB—89-851877/XAB) Magnetic thin films: Faraday rotation and magneto-optical properties. January 1975-December 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 99p. NTIS PC N01/MF N01.

This bibliography contains citations concerning the application of the Faraday effect and other techniques to study thin films with magneto-optical properties. The Faraday effect or Faraday rotation is the rotation of the plane of vibration of a light wave in the thin-film medium when it is subjected to a strong magnetic field. Since the amount of rotation is dependent upon the composition and thickness of the film, it can be used to measure composition, thickness, and magnetization. Also included in these studies are data on anisotropy, magnetic-domain width changes, temperature and spectral dependence, and optical absorption. (Contains 139 citations fully indexed and including a title list.)

13183 **(PB—89-852115/XAB) Maskless ion implantation. January 1975-November 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-November 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 54p. NTIS PC N01/MF N01.

This bibliography contains citations concerning the techniques and applications of maskless ion implantation. Focused-ion-beam microfabrication methods used to produce maskless ion implantation are discussed. Fabrication of microsensors using this technique is described. Maskless ion-beam patterning and writing are also considered. (Contains 68 citations fully indexed and including a title list.)

13184 **(PB—89-852842/XAB) Radiation curing of polymers. December 1986-December 1988 (Citations from the COMPENDEX data base). Report for December 1986-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 99p. NTIS PC N01/MF N01.

Supersedes PB—88-854591.

This bibliography contains citations concerning the radiation crosslinking of thermoplastic and thermosetting plastics and elastomers. Energy efficiency and performance of polymer curing by such radiation as ultraviolet, microwave, and infrared wavelengths are discussed relative to such materials as polymeric coatings, adhesives, elastomers, and epoxy resins. Hazards of radiation curing of polymers as well as applications of the electron-processed plastics are included. (This updated bibliography contains 176 citations, 62 of which are new entries to the previous edition.)

13185 **(PB—89-853626/XAB) Polymer radiation curing: polyester resins. January 1973-December 1988 (Citations from the Rubber and Plastics Research Association data base). Report for January 1973-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 104p. NTIS PC N01/MF N01.

This bibliography contains citations concerning the formulations and processes for radiation curing on polyester resins. Effects of radiation curing on polyester resins are also discussed. Electron-beam and ultraviolet radiation are emphasized. Polymer crosslinking by such electromagnetic wave radiation as in the visible wavelength is also examined. Applications in adhesives, coatings, lacquers, and printing inks are included. (Contains 200 citations fully indexed and including a title list.)

13186 **(PB—89-853634/XAB) Polymer radiation curing: polyester resins. January 1970-December 1988 (Citations from the US Patent data base). Report for January 1970-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 86p. NTIS PC N01/MF N01.

This bibliography contains citations of selected patents concerning the processes and formulations sensitive to radiation curing in polyester resins. Electron-beam and ultraviolet radiation are emphasized. Polymer crosslinking by such electromagnetic wave radiation as in the visible wavelength is also included. Applications in paints, coatings, lacquers, printing inks, laminates, photoresists, and other substrates are discussed. (Contains 166 citations fully indexed and including a title list.)

13187 **(PB—89-853683/XAB) Wood preservatives. December 1985-December 1988 (Citations from World Surface Coatings Abstracts). Report for December 1985-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 101p. NTIS PC N01/MF N01.

Supersedes PB—87-864419.

This bibliography contains citations concerning the formulation, testing, and safety aspects of wood preservatives. Safety aspects pertain to the manufacturing of the wood preservatives, and to the use and application of wood preservatives. (This updated bibliography contains 240 citations, 94 of which are new entries to the previous edition.)

13188 **(SAND—87-3049C) Standardized Bauer PVDF [polyvinylidene fluoride] piezoelectric polymer shock gauge.** Lee, L.M.; Graham, R.A.; Bauer, F.; Reed, R.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 11p. (CONF-880940—4). NTIS, PC A03 - OSTI. Order Number DE89005603/JAW.

From 2. international conference on mechanical and physical behavior of materials under dynamic loading; Ajaccio, France (19 Sep 1988).

A standardized transducer that can respond to shock loading over a large stress range (0.2 to 50.0 GPa) is required for shock wave measurements. A cooperative program has been conducted among our laboratories to provide a well understood and highly reproducible standardized PVDF polymer film gauge to investigate stress wave loading and release. The polymer material source and standardized PVDF piezoelectric stress gauges are based on the work by Bauer. The shock response of standardized PVDF piezoelectric stress gauges produced by SNLA/Ktech, ISL, and commercially has been measured in controlled shock wave experiments using a compressed gas gun. Shock wave response measurements made in the 0.3 to 46.0 Gpa range show excellent agreement among gauges produced by three different facilities. These experiments demonstrated that a repeatable, well understood PVDF stress gauge can be produced if strict specifications are met. These experiments demonstrated PVDF gauges could function repeatably under severe shock loading conditions. Specific applications of this unique stress gauge are also presented. 10 refs., 5 figs., 2 tabs.

13189 **(SAND—88-1636C) What factors control the structure of silica aerogels?.** Schaefer, D.W. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (CONF-8809131—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005599/JAW.

From 2. international symposium on aerogels; Montpellier, France (21 Sep 1988).

By manipulating polymerization conditions in solution precursors, it is possible to control the structure of silica aerogels. Porosity varies from grain-like to polymer-like. When produced from alkoxides, pH is the dominant factor that determines structure. Under strongly basic conditions (pH > 12) compact colloidal particles are observed. In the range pH = 8--12, particles of varying surface roughness result. In the neutral range, polymerization is self-limiting, producing polymers with the geometry of percolation clusters at threshold. Under acidic conditions, highly ramified branched polymers are realized. Using the concept of fractal geometry, different growth processes are identified that account for the observed structure. These processes include Eden growth (reaction-limited monomer-cluster aggregation) under basic conditions and the cluster-cluster analogue under acidic conditions. Kinetic percolation is postulated for the neutral regime. 23 refs., 5 figs.

13190 **(SAND—88-1665C) Adsorption and decomposition of trimethylarsenic on GaAs(100).** Creighton, J.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 7p. (CONF-881155—35). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005598/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Alkylated arsenic compounds have shown some promise as alternatives to arsine as the group-V source gas for GaAs MOCVD. However, little is known about the fundamental chemical interactions of these compounds with the GaAs surface. We have investigated the adsorption and reactivity of trimethylarsenic (TMAs) on GaAs(100) using temperature programmed desorption (TPD), Auger electron spectroscopy, and LEED. For the exposures and temperatures studied, TMSs did not pyrolytically decompose on the GaAs(100). TPD results indicate that TMAs chemisorbs, apparently non-dissociatively, and desorbs ≅ 330 K. Multilayers of TMAs desorb ≅ 140--160 K. Exposure of adsorbed TMAs to 70 eV electron results in irreversible decomposition of the molecule. After electron irradiation, TPD shows that methyl radicals desorb at 660 K, which corresponds to a desorption activation energy of ≅ 40 kcal/mole. At higher temperatures, As_2, H_2, C_2H_2, and a smaller amount of methyl radicals desorb, and a small coverage of carbon remains on the surface. 10 refs., 4 figs.

13191 **(SAND—88-1860C) The response of metal-oxide-semiconductor devices irradiated at high temperatures.** Schwank, J.R.; Sexton, F.W.; Fleetwood, D.M.; Rodgers, M.S.; Hughes, K.L. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 17p. (CONF-890103—6). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005605/JAW.

From 6. symposium on space nuclear power systems; Albuquerque, NM, USA (9 Jan 1989).

To study the combined effects of high temperature and radiation on metal-oxide-semiconductor (MOS) integrated circuits (ICs), we have performed a series of experiments to characterize the response of MOS 16k static random access memories (SRAMs) irradiated at temperatures from 298 to 398 K. The irradiations were performed at dose rates approaching those of a spacebased nuclear reactor (≅ 0.03 rad/s). Over the temperature range investigated, the failure dose of 16k SRAMs was found to decrease with increasing temperature due to complex interactions between radiation and temperature. Neither the failure mechanism nor the failure dose could be predicted from separate or independent measurements of room-temperature irradiation data and IC response preirradiation as a function of temperature. These results show that over the temperature range 298 to 398 K one cannot depend on elevated temperatures to extend the lifetime of ICs in a radiation environment. Extensive qualification tests must be performed if ICs on a space nuclear power platform are to be exposed to high radiation levels in this temperature range. At temperatures much higher than 400 K, however, defect annealing can significantly increase the radiation tolerance of MOS circuits.

13192 **(UCID—21606) Polymer highlights for September 1975.** Hammon, H.G.; Althouse, L.P.; Buckner, A.T.; McKinley, B.; Walkup, C.M.; Rinde, J.; Lorensen, L.L.; Cady, W.E.; Caley, L.E. (Lawrence Livermore National Lab., CA (USA)). 15 Dec 1988. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005502/JAW.

Research programs in polymer chemistry are briefly described. The following polymers are under investigation for use as adhesives, nozzles, insulators, or fluid cushions: urethanes, teflon, TFE, Tefzel, Ryton, H Resin, Imidite 2803, PPQ, KELF 800, and KELF 5500. Areas of research application include geothermal and solar energy fields. (CBS)

13193 **(UCRL—21135) Characterization of IM7/8551-7 carbon/epoxy in compression and shear: Final report for the period October 1987 to September 1988.** Swanson, S.R.; Colvin, G.E. Jr. (Lawrence Livermore National Lab., CA (USA)). 27 Sep 1988. Contract W-7405-ENG-48. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005544/JAW.

This is a final report on a project entitled "Characterization of IM7/8551-7 Carbon/Epoxy in Compression and Shear," for the period October 1987 to September 1988. The intent of this program is to determine the failure properties of carbon/epoxy laminates under multiaxial stress loadings, with particular emphasis on loadings involving compressive stresses. The work accomplished to date is summarized here, in the form of two published papers and a summary of other work. Appendix C contains a summary of the development of the multiaxial compression test fixture. 11 figs.

13194 **(UCRL—100017) The prime importance of second-order effects in rigid-rod polymers.** DeTeresa, S.J.; Farris, R.J. (Lawrence Livermore National Lab., CA (USA)). 22 Nov 1988. Contract W-7405-ENG-48. 7p. (CONF-881155—21). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004809/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

The torsion modulus of high performance rigid-rod polymer fibers is shown to be dependent on axial tensile stress. This behavior is one of at least second-order elasticity. Fiber ultimate tensile strengths are of the same magnitude as torsion moduli, and increases in torsion moduli in excess of 200% were observed for fibers under tension. Consideration of the effect of axial compressive stress on fiber torsion modulus leads to a prediction of an elastic shear instability that initiates at a compressive stress approximately equal in magnitude to the zero-stress torsion modulus. Hence, it is concluded that the compressive strengths of high performance polymer fibers are limited by the onset of an elastic microstructural instability. 4 figs., 7 refs., 1 tab.

13195 **(RFP-Trans—480) Process for production of silica gel.** Yoshida, Ichiro. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Sep 1988. Contract AC04-76DP03533. Translated from Japanese Patent 62-241816, 1987. 8p. NTIS, PC A02/MF A01. Order Number DE88017040/JAW.

Silica gel is produced by the Si alkoxide hydrolysis method, using a new technique in which evaporation is effected when the Si alkoxide concentration is above 40 mole percent, thus drying the liquid sol or gel before the Si alkoxide is completely decomposed and obtaining a dry gel. Examples of this process are presented. 1 fig.

13196 **(LA-tr—88-26) Production of graphite whisker.** Yamada, Yasuhiro. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. Translation of Japanese patent No. 61-266398. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004732/JAW.

This invention concerns the method to produce graphite whisker which have excellent physical property through the heat-processing method at above 2000 degrees C temperature after pre-processing active carbon with mineral acid.

13197 **Dislocation-solute interactions at twin boundaries in dendritic web silicon.** Jayaram, R.; Spitznagel, J.A.; Meier, D.L.; Greggi, J.; Burke, M. (Univ. of Pittsburgh, Pittsburgh, PA (US));. pp v of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

DLTS, TEM and APFIM techniques have been used to study impurity-defect interactions responsible for reducing minority carrier diffusion lengths in solar cells of dendritic web silicon. Fine scale precipitates of S10/sub x/, which decorate dislocations piled up at the twin planes in low efficiency cells, appear to be the dominant recombination centers.

13198 **Cathodoluminescence of InGaAs-GaAs single heterostructures.** Fitzgerald, E.A.; Kavanagh, K.L.; Ast, D.G.; Kirchner, P.D.; Pettit, G.D.; Woodall, J.M. (Dept. of Materials Science and Engineering, Cornell Univ., Ithaca, NY (US));. pp v of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Mismatched InGaAs-GaAs epitaxial layers were grown by molecular beam epitaxy (MBE) on substrates containing 9800 or $<$100 dislocations/cm/sup 2/. Cathodoluminescence (CL), transmission electron microscopy (TEM), Rutherford backscattering spectroscopy (RBS), and energy dispersive x-ray analysis (EDX) were used to analyze the effect of mismatch and substrate dislocation density on interface morphology. Surface ridges in scanning electron microscopy (SEM) images were found to correlate with areas of high recombination in CL. The spacing of dark recombination lines seen in CL was found to be an order of magnitude larger than the spacing of misfit dislocations seen in TEM. CL/TEM correlation reveals that some areas of the misfit array act more strongly as recombination centers than others. CL of step etched samples show that interface defects propagate into the GaAs buffer layer to depths of 4000 A below the interface. The substrate dislocation density does not have a major effect on the number or spacing of the dark recombination lines.

13199 **SANS studies of the configurations of single chains in heterogeneous block copolymers.** Berney, C.V.; Cheng, P.; Kofinas, P.; Cohen, R.E. (Massachusetts Institute of Technology, Cambridge, MA (US));. pp v of Scattering, deformation, and fracture in polymers. Wignall, G.D.; Crist, B.; Russell, T.P.; Thomas, E.L. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Small-angle neutron scattering studies of polystyrene-polybutadiene diblock copolymers of spherical morphology are discussed, with emphasis on the effect of this morphology on the spatial organization of the polymer chains. Three particular cases are examined: (i) the distribution within the matrix of added (matrix) homopolymer, (ii) the distribution within the spherical microdomains of added (microdomain) homopolymer, and (iii) isotopic effects occurring in the B domains when a B-deuterated diblock SB/sub d/ is blended with a normal sample SB. Deviations from ideal mixing are found in all three cases.

13200 **Impact of isotope effects on the SANS analysis of amorphous polymers.** Bates, F.S.; Koehler, W.C.; Wignall, G.D.; Fetters, L.J. (AT and T Bell Labs., Murray Hill, NJ (US));. pp v of Scattering, deformation, and fracture in polymers. Wignall, G.D.; Crist, B.; Russell, T.P.; Thomas, E.L. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Binary mixtures of the perdeuterated and protonated isotopes of four amorphous polymers-polystyrenes, 1,4-polybutadienes, 1,2-polybutadienes, and 1,2-polybutenes - have been examined by small-angle neutron scattering (SANS). In each case, evaluation of the SANS results based on the RPA theory of the Gennes indicates non-ideal mixing characterized by a Flory-Huggins interaction parameter 10/sup -4/ $<$ chi $<$ 10/sup -3/. All four chi parameters can be closely predicted based on the measured change in the carbon-hydrogen bond polarizability with deuterium substitution. These findings are discussed in the context of past SANS studies of amorphous polymers.

13201 **The physics of photons and neutrons with applications of deuterium labeling methods to polymers.** Wignall, G.D. (National Center for Small-Angle Scattering Research, Oak Ridge National Lab., Oak Ridge, TN (US));. pp v of Scattering, deformation, and fracture in polymers. Wignall, G.D.; Crist, B.; Russell, T.D.; Thomas, E.L. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Over the past decade small-angle neutron scattering (SANS), has found numerous applications in the fields of biology, polymer science, physical chemistry, materials science, metallurgy, colloids, and solid state physics. In view of the large numbers of nonspecialists who are increasingly using neutron scattering, the need has become apparent for presentations which can provide rapid access to the method without unnecessary detail and mathematical rigor. In the field of polymer science several reviews have been written to meet this need including a recent comprehensive survey of neutron scattering studies of polymers to which reference will be made for detailed derivations of the expressions used below. This article, along with others in this volume, is meant to serve as a general introduction to the symposium "Scattering Deformation and Fracture in Polymers," and is intended to aid potential users who have a general scientific background, but no specialist knowledge of scattering, to apply the technique to provide new information in areas of their own particular interests. In view of space limitations, the general theory will be given in the case for neutron scattering and analogies and differences with photon scattering (x-rays) will be pointed out at the appropriate point.

13202 **Low temperature oxidation and spalling of electrodeposited and vapour-deposited cooper.** Fisher, R.M.; Martin, B.; Cannon, R.M. (Center For Advanced Materials, Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US));. pp v of Thin films: Interfaces and phenomena. Namanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

Thermal cycling of silicon solar cells heated with incandescent light or using an in-situ heating stage on an optical microscope caused unexpectedly rapid oxidation of the electrodeposited copper current collecting grid. Usually fine buckling and spalling of the oxide film also occurred at temp as low as 180°C. These effects appear to stem from the very fine columnar grains and high defect content of the copper ribbons and some Cl residue from the electrolyte. With vapour-deposited Cu, similar relatively rapid oxidation and spalling were also observed. Origins of the high oxidation rates, the large compressive stresses within the oxide and the low-temperature spalling are discussed.

13203 **Structural evaluation of interfaces by electron diffraction.** Sullivan, T.D.; Ast, D.G. (IBM Burlington, Essex Junction, VT (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

A method for extracting quantitative information from weak diffraction features at or near matrix reflections is described. The technique requires an accurate knowledge of the fall-off of the matrix reflection. This fall-off was studies both experimentally and theoretically for a wide range of coherence conditions in the microscope. Subtraction of this matrix contribution from the total intensity of an [004] twist boundary shows that the streak arises from local as well as from long range interference effects. The latter contribution varies with spatial coherence length which depends on the condenser setting of the microscope.

13204 **Automatic iterative fitting of RBS spectra from multielement samples.** Eridon, J.; Was, G. (Univ. of Michigan,, Dept. of Nuclear Engineering, Ann Arbor, MI (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

A computer code (BASF) has been constructed to perform automatic interative fitting of smoothed Rutherford Backscattering Spectra using only the experimental spectrum and the parameter set defining the experiment. The code may be used to analyze anywhere from two to five elements. The code output consists of the total amount of each element present and a composition versus depth profile. The code's performance was verified experimental backscattering spectra. Samples consisting of nickel substrates onto which layers of nickel and aluminum have been alternately evaporated were used to produce backscattering spectra. These spectra, when analyzed, demonstrated that the code was able to determine the total aluminum content to within a 5% and the ratio of aluminum to nickel within 1% of the thickness monitor readings taken during evaporation. The code has also shown the ability to recognize sharp interfaces in well resolved spectra. The ultimate limits on the code's accuracy are the resolution of the spectrum and the accuracy of the computer stopping powers.

13205 **Interfacial reactions between amorphous W-Si thin films and polycrystalline overlayers.** Thomas, R.E.; Perepezko, J.H.; Wiley, J.D. (Materials Science Center, Univ. of Wisconsin-Madison, 1500 Johnson Driv,, Madison, WI (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

Interactions between amorphous metal thin films and either a substrate or an overlayer can limit their effectiveness as diffusion barriers. The authors found in previous studies that Au and Al polycrystalline thin films in contact with amorphous W-Si lowers the crystallization temperature of the a-(W-Si) by at least 100C. In contrast Cu and Mo have no apparent effect on the stability of the amorphous layer. The mechanisms leading to premature crystallization are not well understood. Amorphous W/sub .72/Si/sub .28/ was deposited by D.C. sputtering onto single crystal Si substrates. Overlayers of Al were then evaporated onto the W-Si. Using Auger electron spectroscopy depth profiling coupled with cross-section TEM, the authors studies interfacial reactions between the amorphous layer and polycrystalling Al. Auger profiling results show that in the case of Al overlayers, W and Si diffuse out of a a-(W-Si) into the Al where WAl/sub 12/ forms. These results can be explained in the context of three binary diffusion couples, W-Si, W-Al, Al-Si, and the individual interactions associated with these couples.

13206 **Phase formation sequence in the Pd-GaAs sytem.** Sands, T.; Keramidas, V.G.; Yu, A.J.; Yu, K.M.; Gronsky, R.; Washburn, J. (Bell Communications Research, Inc., Murray Hill, NJ (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

The morphological aspects of ternary phase formation during the Pd-GaAs reaction have been studied by application of transmission electron microscopy (TEM) and Rutherford backscattering (RBS) techniques. The TEM images show that the first product "phase I", forms during deposition of Pd onto (100) GaAs and exhibits the preferred orientation [0001]/sub I/ — // [011-bar]/sub GaAs/. In the presence of unreacted Pd, the second phase "phase II", nucleates at large-angle grain boundaries in the phase I film as the annealing temperature increases above — 250°C. Energy dispersive analysis of x-rays and RBS suggest that both phases I and II have nominal compositions in the range of Pd/sub 3/GaAs to Pd/sub 4/GaAs.

13207 **Epitaxial formation of rare earth silicides by rapid annealing.** Knapp, J.A.; Picraux, S.T. (Sandia National Labs., Alburquerque, NM (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

Rapid electron beam and lamp heating have been used to form thin epitaxial films of rare-earth silicides by reacting overlayers of the rare earths with (111) Si substrates. Of the metals Y, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu, all but Gd are found to form epitaxial silicide layers by rapid solid-phase reaction, while silicides of Gd, Dy, Tm, Yb and Lu have been formed epitaxially by liquid phase reaction. For all but Er this is the first demonstration of epitaxial growth on Si. Details obtained from ion beam channeling analysis and transmission electron microscopy confirm the expected epitaxial structure and also show that the Si vacancies in the silicide from an ordered superlattice, rather than a random array as had been assumed before.

13208 **Ion-beam induced silicide formation.** Hung, L.S.; Mayer, J.W. (Dept. of Materials Science and Engineering, Cornell Univ., Ithaca, NY (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

The moving species in near-noble metal silicide formation was investigated using embedded markers and Rutherford backscattering. With thermal annealing of Ni-silicides, Ni is the dominant diffusing species while in ion-induced reactions both Ni and Si diffuse across the silicide. This difference in behavior is not a result of the formation of amorphous Si during ion irradiation nor is it caused by release of Si. The authors propose that the diffusion of Si is associated with the formation of defects in the silicide layer generated within the collision cascade.

13209 **Dominant moving species in the formatio of amorphous HfNi by solid- state reaction.** Cheng, Y.T.; Nicolet, M.A.; Johnson, W.L. (California Institute of Technology, Pasadena, CA (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

The displacements of Mo, Zr and Pd markers have been monitored by backscattering of MeV He/sup +/ to study the growth of the amorphous HfNi phase by solid-state reaction. The authors find that the is the dominant moving species in this reaction.

13210 **A grazing incidence x-ray study of interfacial reactions in Al-Cu.** Heald, S.M.; Chen, H.; Tranquada, J.M. (Brookhaven National Lab., Upton, NY (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

The Al-Cu system has been used to test the application of grazing incidence EXAFS and x-ray reflectivity measurements to interface systems. Both techniques have been found to be sensitive to compound formation and interdiffusion, and with further development of analysis procedures should be very useful complements to more traditional techniques.

13211 **Early stages of reaction between amorphous Ni-Nb and crystalling Au films.** Dobisz, E.A.; Craighead, H.G.; Perepezko, J.H.; Wilex, J.D.; Doyle, B.L.; Peercy, P.S. (Bell Communications Research, Holmdel, NJ (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

Thin film interactions between a-(Ni-Nb) and polycrystalline Au overlayers have been studied with high depth resolution (≦1.7nm) Rutherford backscattering (RBS) and TEM to obtain information on the early stages of reaction at the interface. The RBS spectra from Au indicated that the interdiffused samples consisted of two layers: an Au-Nb binary layer on the surface and a ternary Au-Ni-Nb compound layer beneath the binary layer. The growth kinetics of the ternary compound layer differed in samples which had been relaxed prior to Au deposition from the kinetics for unrelaxed samples. Furthermore, cross section TEM micrographs showed that relaxed and unrelaxed samples exhibit different microstructures after the early stages of annealing. The authors interpret this result to indicate that the reaction stages in relaxed samples are not as advances as those in the unrelaxed samples.

13212 **Heterojunction ohmic contacts to Si using Ge/Si n/sup +//n/sup +/ structures.** Hafich, M.J.; Gillenwater, R.L.; Robinson, G.Y.; Sheldon, P. (Colorado State Univ., Fort Collins, CO (US));. pp v of Thin films: Interfaces and phenomena. Namanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

Ohmic contracts to n-type Si have been formed using a thin n/sup +/ layer of Ge grown by selective-area molecular beam epitaxy. The n/sup +/Ge is used to lower the metal-semiconductor barrier energy and thus reduce the contact resistivity of the thin film structure. Al/n/sup +/Ge/n/sup +/Si test devices were fabricated in a manner compatible with conventional VLSI processing and consisted of a 3500 Angstrom thick layer of arsenic-doped Ge grown at 250°C on a selectively diffused, phosphorus-doped Si substrate. Using both four terminal Kelvin and transmission line devices, unsintered Al/Ge/Si structures exhibited contract resistivities a factor of five lower than Al/Si control devices, in agreement with theoretical calculations based on a simple tunneling model for the metal/Ge/Si heterojunction ohmic contract.

13213 **The oxidation behavior of the √x√ Ag and Au/Si(111) surfaces at room temperature studired by photoemission.** Yen, J.J.; Friedman, D.J.; Cao, R.; Hwang, J.; Nogami, J.; Lindav, I. (Stanford Electronics Labs., Stanford, CA (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

The differences of the room temperature oxidation behavior of ordered Ag/Si(111) and Au/Si(111) surfaces were studied by surface sensitive soft x-ray photoemission spectroscopy obtained with synchrotron radiation. Si surfaces covered with a monolayer of Ag or Au, once annealed to display a Λ3xΛ3 LEED pattern, were believed to be passivated against oxidation according to earlier reports. This work shows that these two surfaces oxidize but in a different way. Up to 10/sup 4/ L 0/sub 2/ exposures, the observed valence band of the Au/Si surfaces's valence band electron energy distribution curve is almost identical to that of the surface before oxygen exposure. But the corresponding Si 2p core level spectrum shows a small chemically shifted component indicating an initial stage of the formation of Si oxide. This chemically shifted signal becomes a strong peak at -3.7 eV below the clean Si position, characteristic of SiO/sub 2/, after subsequent O/sub 2/ exposures up to 10/sup 10/ L. The Ag/Si system behaves in a similar fashion, but oxide growth saturates at 10/sup 8/ L, and the final oxides formed include a distribution of suboxides in addition to SiO/sub 2/. Clearly, oxide formation is not prohibited by the presence of the ordered Au or Ag metal overlayer but delayed. Although the onset of oxidation is delayed compared to that for the clean Si surface, due to the metal-silicon bonding, the oxide formation is much faster once the surface starts to oxidize.

13214 **Decohesion of thin films from ceramic substrates.** Cannon, R.M.; Fisher, R.M.; Evans, A.G. (Center For Advanced Materials, Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

Decohesion of thin films from ceramic or semiconductor substrates is strongly influenced by internal stresses in films and stress concentrations from edges or flaws as well as by interfacial

fracture energy. Residual stresses can cause spontaneous delamination, splitting and curling of films under tension or delamination, buckling and spalling of films under residual compression, even with good interfacial bonding. Delamination behavior is considered using simple fracture mechanics models, supplemented with preliminary measurements of interfacial fracture energies. Formation conditions largely control internal stresses in films; whereas fracture energies are dictated by interfacial chemistry and mechanical factors such as plasticity.

13215 **The structure and electrical properties of Au contacts to GaAs.** Liliental-Weber, Z.; Newman, N.; Spicer, W.E.; Gronsky, R.; Washburn, J.; Weber, E.R. (Lawrence Berkeley Lab., 62-203, Univ. of California, Berkeley, CA (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

The structure and electrical properties of Au contacts to GaAs have been studied by analytical and high-resolution transmission electron microscopy (TEM) combined with electrical characterization and photoemission spectroscopy (PES). The contacts were prepared by in-situ deposition of Au onto ultra-high vacuum cleaved n-GaAs (110) surfaces. The effects of annealing on the electrical, morphological and chemical properties of the Au:GaAs contacts were studies. It was shown that the formation of Schottky contracts is correlated with the change in stoichiometry of the GaAs substrate near the Au/GaAs interface. The change to ohmic behavior for the samples annealed above Au-Ga eutectic was explained by leakage currents at the periphery of the devices. TEM micrographs of the structures revealed the existence of elongated Au crystallites on the GaAs surface at the periphery of the contacts. These leakage currents were eliminated by removing the current path at the periphery using a mesa-etch.

13216 **Ion beam mixing of marker atoms in Mo and Ru and heat of mixing.** Kim, S.J.; Paine,, B.M.; Nicolet, M.A.; Averback, R.S. (California Institute to Technology, Pasadena, CA (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

The effect of the heat mixing, Δ/sub m/, on the ion beam mixing of marker systems was studied. The matrices for the experiment were Mo and Ru, and marker atoms were Ti, Cr, Mn, Mi, Hf, Ta, Pt, and Au. These markers and matrices have heat of mixing ranging from +65 to -227 kJ/mol. Irradiations were done with 300 keV Kr at 77 and 300 with room temperature backscattering spectrometry analysis. There was no correlation between the mixing results and heat of mixing, which is consistent wit the idea of ion beam mixing of dilute marker system.

13217 **Mechanical properties of metallic films on sapphire.** List, F.A.; McKee, R.A. (Oak Ridge National Lab., Metals and Cermanics Div., P.O. Box X, Oak Ridge, TN (US));. pp v of Thin films: Interfaces and phenomena. Nemanich, R.J.; Ho, P.S.; Lav, S.S. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512142—).

From Thin films: interfaces and phenomena; Boston, MA, USA (2 Dec 1985).

A knowledge of interfacial mechanical properties is of considerable importance to the areas of oxidation, corrosion, metallization, and composite materials. The authors have developed an experimental apparatus capable of simultaneous measurements of elastic and anelastic properties of materials in controlled atmospheres (10/sup -6/ to 10/sup 4/ Pa) form 25 to 1000°C. The apparatus employs the technique of dynamic resonance in which a material's mechanical resonance spectrum can be determined over a range 10/sup 2/ to 10/sup 5/ Hz with resolution +-0.001 Hz. This resolution has enabled us to determine the mechanical properties of films as thin as approximately 10 nm. The authors present resonance results for thin films (—100 nm) of nickel and gold on sapphire substrates. These results suggest that nickel films on sapphire are adherent, i.e., cyclic strain is continuous at the film-substrate interface, over a range of temperature about the film growth temperature; whereas gold films show nonadherent behavior at all temperatures studied.

13218 **TEM investigation of polar-on-nonpolar epitaxy: GaAs-AlGaAs on (100) Ge.** Mazur, J.H.; Washburn, J.; Henderson, T.; Klem, J.; Masselink, W.T.; Fischer, R.; Morkoc, H. (Materials and Molecular Research Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US));. pp v of Layered structures, epitaxy, and interfaces. Gibson, J.M.; Dawson, L.R. Pittsburgh, PA; Materials Research Society (1985). (CONF-841157—).

From Materials Research Society annual meeting; Boston, MA, USA (26 Nov 1984).

Morphologically excellent GaAs and AlGaAs epitaxial layers have been grown on (100) Ge substrates by molecular-beam epitaxy (MBE). Transmission electron-microscope (TEM) studies of the thin-film cross sections revealed that defects, most probably antiphase domains, were contained within a 20-30 nm thick initial layer near the GaAs/Ge interface, formed with a 0.1-μm/h growth rate at 500°C. A reduction of defects occurred in the remaining 0.1-μm/ thick layer, for which the growth rate and temperature had been increase to 1μm/h and 580°C, respectively. The interface between this GaAs layer and a subsequently grown 35-nm thick AlAs film was found to undulate with a period of 150-200 nm and an amplitude of 5-10 nm. Such large undulations were not observed in AlGaAs-GaAs superlattices grown after an additional deposition of 2-μm GaAs. High-resolution electron-microscopy observations suggest that transitions between different layers are abrupt on the atomic scale. In addition, modulation-doped field-effect transistors fabricated on these layers had similar characteristics to those obtained with MBE layers grown on GaAs substrates. These results demonstrate that the (100) Ge surface is suitable for MBE polar-on-nonpolar semiconductor growth and that the integration of III-V films with silicon electronic devices via epitaxial Ge on Si is feasible, provided that epitaxial Ge of sufficient quality grown on Si is available.

13219 **A model of amorphous silicon layer regrowth.** Ling, P.; Washburn, J. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US));. pp v of Ion beam processes in advanced electronic materials and device technology. Appleton, B.R.; Eisen, F.H.; Sigmon, T.W. Pittsburgh, PA; Materials Research Society (1985). (CONF-850421—).

From 2. spring meeting of the Materials Research Society; San Francisco, CA, USA (15 Apr 1985).

A new model which combines heterogeneous nucleation and growth process to explain the mechanism of the crystal regrowth of amorphous silicon, in contact with a Si single crystal substrate, is presented. This model explains the effects of substrate orientation and impurity concentration on the kinetics of crystal regrowth. A comparison of experimental results with the predictions of the model is also included.

13220 **Effects of different methods of calculating mixed depth upon the mixing rates during ion beam mixing.** Poker, D.B.; Appleton, B.R. (Oak Ridge National Lab., Oak Ridge, TN (US));. pp v of Ion beam processes in advanced electronic materials and device technology. Appleton, B.R.; Eisen, F.H.; Sigmon, T.W. Pittsburgh, PA; Materials Research Society (1985). (CONF-850421—).

From 2. spring meeting of the Materials Research Society; San Francisco, CA, USA (15 Apr 1985).

The linearity of mixing rate of ion-beam mixing of metals on silicon has been found to depend critically upon the method by which the mixed depth is calculated. For nonstoichiometric mixing, several methods of calculating the mixed depth may be used, namely: integrated area, half-height, moment, error function, and 10%-90%. When applied to the same data, these methods can yield divergent results, from linear to square-root dependences of the mixed depth upon the mixing dose. For stoichiometric mixing, the calculation of mixed depth is more straightforward, but different methods of calculation still yield widely differing results. Possible causes for these discrepancies are discussed.

13221 The formation of amorphous silicon by light ion damage. Shih, Y.; Washburn, J.; Weber, E.R.; Gronsky, R. (Lawrence Berkeley Lab., Berkeley, CA (US));. pp v of Ion beam processes in advanced electronic materials and device technology. Appleton, B.R.; Eisen, F.H.; Sigmon, T.W. Pittsburgh, PA; Materials Research Society (1985). (CONF-850421—).

From 2. spring meeting of the Materials Research Society; San Francisco, CA, USA (15 Apr 1985).

A model for formation of amorphous silicon by light ion implantation is proposed. It is suggested that accumulation of point defects and/or complexes is required at the initial stage of the amorphization process. Amorphous zones can only form at the end of incoming light ion tracks when the pre-accumulated concentration of point defects reaches a critical value. Depending on the uniformity of the point defect distribution two possibilities for the second stage of amorphization are suggested when ion implantation is performed at different temperatures. Silicon wafers implanted with boron ions below and above the critical amorphization dose at various temperatures have been investigated using cross section specimens in high resolution TEM. Complementary analyses of these specimens by Electron Paramagnetic Resonance have revealed the presence of dangling bonds in amorphous zones and point defect clusters. Extrinsic stacking faults with 1/3 <111> displacements and other smaller distortions with 1/x<111> displacements were also found to result from the amorphization process. Liquid nitrogen temperature was found to be necessary to cause complete amorphization of silicon by boron ion implantation.

13222 Magnetic properties of ions implanted in glass; Fe in SiO/sub 2/. Weeks, R.A.; Silva, M.C.; Kordas, G.; Kinser, D.L.; Martinelli, J.; Appleton, B.R. (Vanderbilt Univ., Nashville, TN (US));. pp v of Ion beam processes in advanced electronic materials and device technology. Appleton, B.R.; Eisen, F.H.; Sigmon, T.W. Pittsburgh, PA; Materials Research Society (1985). (CONF-850421—).

From 2. spring meeting of the Materials Research Society; San Francisco, CA, USA (15 Apr 1985).

Silica glass platelets have been implanted with Fe(+) ions, 125 KeV and 10Λ-5 A to doses of 10Λ14 cmΛ-2, 10Λ15 cmΛ-2, 10Λ16 cmΛ-2 and 5 x 10Λ16 cmΛ-2. Ion scattering measurements show that the peak of the Fe ion distribution is —95 nm below the sample surface, approximately Gaussian, with a width at half maximum amplitude of 100 nm. The intensity of a component in the EPR spectra of implanted samples with a width of 300 gauss and an approximately isotropic shape increases with increasing dose. The increase, proportional to dose for doses <10Λ16 cmΛ-2, is larger for doses ≧ 10Λ16 cmΛ-2. In addition for doses ≧10Λ16 cmΛ-2, the component is orientation dependent. Subsequent heat treatments in air at 700° and 800°C alter the shape, intensity, and orientation dependence of the component. The spectral component in as-implanted samples is attributed to paramagnetic states of Fe ions. The threshold for magnetic exchange interactions and consequently long range magnetic ordering at —300K occurs at a dose ≧10Λ16 cmΛ-2. Data on effects of thermal treatments on intensities and shapes are interpreted in terms of changing chemical composition of precipitating particles.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 12530, 12598, i3109, 13177, 13252, 13262, 13267, 13315, 13574, 13575, 13587, 13955

13223 (BARC—1370) Method for the purification and estimation of milligram amounts of thorium-229 from bulk uranium-233. Ramaswami, A.; Singh, R.J.; Rattan, S.S.; Satyaprakash. (Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1988. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704989/JAW.

The preliminary separation is carried out by adsorbing Th/sup +4/ charged species on cation exchanger. The final purification is done by adsorbing thorium from 7M nitric acid medium on anion exchanger and eluting it out with PH-2 nitric acid. /sup 229/Th and /sup 228/Th are estimated by direct gamma-ray counting of the daughter products and also by following the growth of the alpha activity, due to the growth of the daughter products in the purified thorium fraction. (author). 4 figs., 9 refs.

13224 (BARC—1398) X-ray fluorescence method for the determination of Ba, Sr, Mo and Bi in thorium oxide. Dixit, R.M.; Deshpande, S.S. (Bhabha Atomic Research Centre, Bombay (India). Spectroscopy Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1988. 11p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704991/JAW.

A simple and rapid X-ray fluorescence method for the determination of Ba, Sr, Mo and Bi in thoria is described. Thorium oxide samples are dry-mixed thoroughly with pure boric acid in the ratio of 9:1. One gram of mixture is pressed as a double layer over a primary boric acid pellet. The precision and accuracy of the method have been determined. The power limits of detection are found to be around 20 ppm for most analytes. (author). 5 tables.

13225 (BARC—1404) Gold estimation in geological samples using energy dispersive X-ray fluorescence spectroscopy. Sawhney, K.J.S.; Lodha, G.S.; Bhat, C.K. (Nuclear Research Lab., Srinagar (India)). (Bhabha Atomic Research Centre, Bombay (India)). 1988. 17p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704995/JAW.

Gold concentration in Indus river sediments have been estimated using energy dispersive X-ray fluorescence (EDXRF) spectrometry. To get the best possible detection sensitivity, optimisation of sample preparation procedure and exciting radiation was done. Physical preconcentration procedure of panning of heavy minerals has been employed. Samples were dissolved in acqua regia to homogenize the distribution of gold. For obtaining an optimum excitation sensitivity, radioisotope sources of various energies as well as a low power laboratory built transmission type Mo X-ray tube have been used. L shell X-rays of gold have been used for qualitative analysis. For quantitative estimation, a combination of single element fundamental parameter method and scattered radiation standardisation method was used. The sensitivity of EXDRF spectrometer for gold was around 50 ppm. (author). 6 figs., 2 tables.

13226 (BNL—41859) Maximum information with minimum complexity from a coincidence assay system. Zucker, M.S. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 22p. (BNL/NPB—88-97; CONF-880910—1-FP). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002909/JAW.

From Industrial radiation and radioisotope measurement applications; Pinehurst, NC, USA (7 Sep 1988).

Nuclear assay based on coincidence measurements can yield more useful information than is usually derived from them. The additional information can be used to improve assay accuracy and reliability with only a modest increase in the complexity of the electronics. A particular three-channel coincidence system that has had practical application is analyzed as an example. 3 refs., 7 figs., 1 tab.

13227 (CEA-N—2578) Standard cartridges used in gamma spectrometry measurements of radioactive halogens. Lepy, M.C.; Etcheverry, M.; Morel, J.; Chauvenet, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Office des Rayonnements Ionisants). Oct 1988. 34p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756657/JAW.

Activated charcoal cartridges are used to trap radioactive halogens contained in gaseous effluents of nuclear facilities. Two types of standard cartridges, with barium 133 or europium 152 are available. One of the models simulates a volumic distribution, and the other a surface distribution of the radionuclides inside the cartridge. They are characterized in terms of activity with an uncertainty lower than 5 %. The standard cartridges utilization conditions are specified and the main measurement error causes are ana-

lyzed. The proper routine use of these standards should allow us to get results with an accuracy better than 10 %.

13228 **(CNIC—00079) Photometric determination of trace cadmium in waste water drained from uranium mining and water-metallurgy.** Zhu Zihui; Gu Gang; Xu Quanxiu. (Suzhou Medical Coll., JS (China)). (China Nuclear Information Centre, Beijing, BJ). Sep 1987. 6p. (In Chinese). (SMC—0008). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705035/JAW.

Cadmium (Cd) ions react with dithizone to form a pink to red color that can be extracted with chloroform and measured photometrically. Dithizone method is one of standard method to determine trace Cd in the environmental waste water. This method, however, can not be suitable for measuring the trace Cd in the waste water drained from uranium mining and water-metallurgy factory, because this kind of waste water contains magnesium ions as high as 1500 mg/L. One more discomfort is that the method needs to use a large amount of potassium cyanide. The authors, therefore, used potassium fluoride as a precipitator that removed the excess magnesium ions in the experimental system, and tried to reduce the amount of potassium cyanide to 1/20 of original usage. The experimental results indicated that the modified method as mentioned above was very satisfactory either to simulated samples or to actual samples of waste water drained from uranium mining and water-metallurgy plants. In Summary, this modified method has higher sensitivity with minimun detectable quantity of 0.02 ppm and it is accurate and reproducible with recovery rate of 100 +- 5%.

13229 **(CNIC—00105) Determination of uranium (IV) by flow voltammetry.** Ding Anqing. (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). (China Nuclear Information Centre, Beijing, BJ). 1987. 11p. (In Chinese). (IAE—0030). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705047/JAW.

According to the quantitative reaction of U(IV) and Fe(III) in H/sub 2/SO/sub 4/ as well as the relation between current and concentration of substance detected, U(IV) has been determined indirectly by measurement of the electrolysis current of residual Fe(III). The columniform electrode used is made of glass carbon particles. At the range of U(IV) from a few micrograms to 40 μg, the linear relation is excellent. The relative standard deviation is within +-4%. The interference of Fe(II), Ti(IV) and U(VI) is negligible but of Ti(III) is serious. This method has been successfully applied in the determination of actual samples (both out line and on line). Main advantages of this procedure are rapid, simple, small amount of sample (only at microgram level) and easy to realize automation, able to use for on line or process analysis.

13230 **(CNIC—00121) Simultaneous determination of uranium and thorium in ores with chlorophosphonazo III by dual-wavelength spectrophotometric method.** Jin Wenlong; Yao Mingxia; Yin Zinan. (Ministry of Nuclear Industry, Henyang, HN (China). Uranium Mining Research Inst.). (China Nuclear Information Centre, Beijing, BJ). 1987. 10p. (In Chinese). (UMRI—0001). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705051/JAW.

An investigation has been made on the color reaction of U and Th with chlorophosphonazo III in phosphoric acid. The Th and U in ores can be determined simultaneously in same solution with chlorophosphonazo III as chromogenic agent by means of dual-wavelength spectrophotometric method. The interference from coexistent components such as RE, Ti and Zr, is eliminated by a separating procedure of extraction chromatography with polydivinylbenzene porous bead-301 supporting trialkylphine oxide. The measuring wavelength and the referential wavelength are 690 nm and 608 nm for Th, 670 nm and 707 nm for U. The calibration curves are linear in the range 0 to 50 μg/25 ml for Th and U. The coefficient of variation is less than 10% for 0.03% - 0.5% of Th and U in ores. The method can be applied to the simultaneous determination of Th and U in a variety of samples.

13231 **(CNIC—00131) Simultaneous determination of nitrate and nitrite in natural water and waste water from uranium mines with dual-wavelength spectrophotometric method.** Jin Wenlong; Yin Zinan; Yao Mingxia. (Ministry of Nuclear Industry, Henyang, HN (China). Uranium Mining Research Inst.). (China Nuclear Information Centre, Beijing, BJ). Dec 1987. 13p. (In Chinese). (UMRI—0002). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705052/JAW.

A new method is described for the simultaneous direct determination of nitrate and nitrite in natural water and waste water from uranium mines with dual-wavelength spectrophotometric method. The measuring wavelength and the referential wavelength are 219 nm and 240 nm respectively. In KH/sub 2/PO/sub 4/ buffer solution(pH7.0), the calibration curves are rectilinear in the range 0 to 4 ppm for NO/sub 3//sup -/-N and NO/sub 2//sup -/-N. The interference from some organic substances, such as amine, is eliminated by treating the samples with polydivinylbenzene porous bead-203. The method is simple and rapid. The coefficient of variation (n = 7) is less than 10% for 0.1 - 20 mg/l of NO/sub 3//sup -/-N and NO/sub 2//sup -/-N. The method has been applied to the determination of 0.05 - 100 mg/l of NO/sub 3//sup -/-N and NO/sub 2//sup -/-N in water from uranium mines.

13232 **(CNIC—00132) Preparation and application of ion-exchange membrane selective electrode.** Li Fugui; Zhang Genwang. (Ministry of Nuclear Industry, Zhengzhou, HEN (China). Fifth Research and Design Inst.). (China Nuclear Information Centre, Beijing, BJ). Jan 1988. 6p. (In Chinese). (FRDIN—0001). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705053/JAW.

A new kind of ion-exchange membrane selective electrode was prepared to determine nitric, hydrochloric and sulphuric acids. The chemical performance of the membrane is stable. The temperature coefficient of the electrode is 0.5 mV. It has a higher selectivity for hydrogen ion. The mechanical performance of the electrode is good. The period of analysis is shorter and the reproducibility is good. The measurement range of hydrogen ion concentration is 1 x 10/sup -3/ to 5 mol/L. The electrode can be used for acidity analysis of strong acids in laboratory and on-line analysis of uranium process solution.

13233 **(CONF-880914—6) Laser-induced fluorescence studies of europium extractant complexes in organic phases.** Beitz, J.V.; Sullivan, J.C. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005806/JAW.

From 18. rare earth research conference; Lake Geneva, WI, USA (11 Sep 1988).

Studies of Eu^{3+} extractant complexes in organic phases of interest in solvent extraction of lanthanides and actinides have been carried out using time- and wavelength-resolved laser-induced fluorescence (LIF). Even at low metal loading, the Eu^{3+} is shown to be present in the organic phase as a single metal ion- extractant complex in which complete dehydration of the metal ion has occurred when the aqueous phase was nitric acid and di(2-ethylhexyl)phosphoric acid or octyl(phenyl)-N,N,-diisobutylcarbamoylmethyl-phosphine oxide were used as extractants. 20 refs., 2 figs., 1 tab.

13234 **(CONF-8809221—1) Processing of low-burnup LEU [low enriched uranium] silicide targets.** Kwok, J.D.; Vandegrift, G.F.; Matos, J.E. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003892/JAW.

From International meeting on reduced enrichment for research and test reactors (RERTR); San Diego, CA, USA (18 Sep 1988).

Currently much of the world's supply of /sup 99m/Tc for medical purposes is produced from ^{99}Mo derived from the fissioning of high enriched uranium (HEU). Substitution of low enriched uranium (LEU) silicide fuel for the HEU alloy and aluminide fuels used in current target designs will allow equivalent ^{99}Mo yields

with no change in target geometries. In these studies, targets were irradiated to low burnup (10/sup {minus}5/%) to produce fission products and ^{239}Np at concentrations conveniently measured by gamma spectroscopy. Processing was done by dissolution of LEU targets in acid or base followed by alumina column recovery ^{99}Mo. Acid dissolution is more rapid, but precipitation of silica results in loss of ^{99}Mo. Dissolution of U_3Si_2--Al targets in base requires more processing steps than the current process for UAl/sub x/--Al fuel. A two-step process of first dissolving the 6061Al cladding and fuel meat aluminum, and then dissolving the U_3Si_2 fuel particles, has the advantage of eliminating the aluminum from further processing. Loss of ^{99}Mo during the aluminum dissolution is attributed to recoil of ^{99}Mo out of the silicide particles during irradiation. A larger particle size would decrease this ^{99}Mo loss. 6 refs., 4 figs., 2 tabs.

13235 **(EGG-M—43487) Molecular primary probe for secondary ion mass spectrometry of organics.** Appelhans, A.D.; Delmore, J.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 2p. (CONF-8808115—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005190/JAW.

From 11. international mass spectrometry conference; Bordeaux, France (29 Aug 1988).

In the course of development of a fast, highly focused neutral molecular primary beam probe for Secondary Ion Mass Spectrometry (SIMS), the question as to the relative efficiency of a molecule versus an atom for producing secondary ions of organic molecules was raised. Theoretical and experimental studies have indicated sputtering efficiency should increase as more energy is deposited near the surface. This would seem to be especially true when trying to sputter large organic molecules that must be desorbed from the surface with minimum molecular heating to remain intact. The kinetic energy of an SF_6 molecule is distributed among 7 atoms and the SF_6 molecule is large (geometrically) compared to an atom. Thus although at equivalent accelerating voltages an SF_6/sup {minus}/ molecular ion (146 u) and a Cs^+ atomic ion (133 u) deposit nearly the same amount of energy, the spatial distribution of this energy on surface will be quite different. The SF_6 molecule will deposit more energy near the surface. To determine if this results in more efficient sputtering of molecules residing on the surface we have compared the SF_6 molecular beam with a Cs^+ atomic ion beam under organic static SIMS conditions. 5 refs., 1 tab.

13236 (INIS-mf—11331, pp 10) **Thermal decomposition of typical ammonium diuranate from a South African mine.** Moolman, D.; Carstens, P.A.B. (Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria). 1988. (In Afrikaans). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705188/JAW. (CONF-8802128—).

From 3. Southern African symposium on thermal analysis; Cape Town, South Africa (2 Feb 1988).

13237 (JINR—D-14-87-799, pp 451-455) **Application of muonic X-rays in archeology.** Daniel, H.; Hartmann, F.J.; Riederer, J. (Technische Univ. Muenchen (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The principal idea and some features of a quantitative chemical analysis with muonic X-ray are considered. A series of runs on archeological objects (acient glass samples) is performed using muonic X-ray spectroscopy. The Roman glasses are shown to be not very different from the Celtic ones. Two classes of acient glasses show little K content and a large amount of Na. 5 refs.; 3 figs.; 3 tabs.

13238 **(Juel—2218) Check of the historical Schoenbein technique for the determination of ozone using a flow tube.** Muehlheims, F.; Volz, A.; Kley, D. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie 2 - Chemie der Belasteten Atmosphaere). Jul 1988. 63p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756400/JAW.

The Schoenbein-technique which makes use of the formation of a blue-colored complex of iodine (produced by oxidation of iodide on filter paper by O/sub 3/) has been tested in a flow tube for its response to O/sub 3/, wind speed, and relative humidity. In addition, the dependence of the coloration on exposure time was investigated. For O/sub 3/ concentrations below 10 ppb, the coloration increased proportional with time for about 8 hours. Then, a plateau was reached that lasted for a few hours. Afterwards, the coloration disappeared with time of O/sub 3/ exposure due to losses of iodine from the paper. The initial slope and the coloration reached during the plateau depended on O/sub 3/ concentration and on humidity. Most important, the length of the plateau was considerably shorter and the decay of the coloration was much faster at higher O/sub 3/ levels. The results, demonstrate that the Schoenbein-technique was ambiguous in the sense that, at the exposure times around 8 hours or more, as they were used during last century, higher O/sub 3/ concentrations may have produced less coloration.

13239 **(MAFF-AEPR—1) Analytical procedures for the determination of neptunium radionuclides in marine waters, sediments and biota.** Harvey, B.R.; Thurston, L.M. (Ministry of Agriculture, Fisheries and Food, Lowestoft (UK). Directorate of Fisheries Research). 1988. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755551/JAW.

Analytical procedures for the determination of neptunium 237, and neptunium 239 in marine waters, sediments and biota are presented.

13240 **(MINTEK-M—321) Determination of molybdenum, arsenic, and uranium in activated carbon by x-ray-fluorescence spectrometry.** Balaes, A.M.E.; Wall, G.J. (Council for Mineral Technology, Randburg (South Africa)). 10 Aug 1987. 8p. the Council for Mineral Technology, Private Bag X3015, Randburg, 2125, South Africa.

A rapid, accurate, precise, and cost-effective method is described for the determination of uranium, molybdenum, and arsenic in activated carbon. Preparation of the sample is minimal, involving only fine grinding of the carbon, the addition of a diluent and a wax-polystyrene binder, and pelletization of the resulting material. The briquettes are analysed with a fully automated X-ray-fluorescence spectrometer, corrections being made for spectral-line overlap and background factors. The lower limit of detection was 1,5 2,1 and 2,0 μg/g for U/sub 3/O/sub 8/, molybdenum, and arsenic respectively. The relative standard deviation did not exceed 0,016 for U/sub 3/O/sub 8/ up to 1250μg/g, 0,068 for molydbenum up to 12,4 per cent, and 0,045 for arsenic up to 1,21 per cent. The accuacy of the method compares favourably with that of other methods.

13241 **(MINTEK-M—357) Determination of minor and trace elements in activated charcoal.** Eddy, B.T.; Wall, G.J. (Council for Mineral Technology, Randburg (South Africa)). 17 Jun 1988. 13p. Mintek, Private Bag X3015, Randburg, 2125, South Africa.

A rapid method using X-ray-fluorescence spectroscopy for the direct analysis of charcoal samples obtained from the carbon-in-pulp process has been developed. The specimens were prepared for analysis from samples of dried charcoal mixed with a diluent containing cerium, which acts as a heavy absorber. The mass-absorption coefficients of the specimens were calculated to show that the absorption effects occuring in the analysis of these samples are too small to account for the deviations in the results obtained. By and large, the method is acceptable for purposes of plant control, but not for the accurate analysis of charcoal samples, which requires ashing, followed by complete dissolution of the sample.

13242 **(N—89-12234) Method for monitoring the variability in nuclear absorption characteristics of aviation fuels.** Sprinkle, D.R.; Shen, C.P. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). 1988. 28p. (NASA-TM—4077; L—16497; NAS—1.15:4077). NTIS, PC A03/MF A01.

A technique for monitoring variability in the nuclear absorption characteristics of aviation fuels has been developed. It is based on a highly collimated low energy gamma radiation source and a

sodium iodide counter. The source and the counter assembly are separated by a geometrically well-defined test fuel cell. A computer program for determining the mass attenuation coefficient of the test fuel sample, based on the data acquired for a preset counting period, has been developed and tested on several types of aviation fuel.

13243 **(PB—89-852875/XAB) Ion-exchange resins. October 1983-December 1987 (Citations from the COMPENDEX data base). Report for October 1983-December 1987.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 198p. NTIS PC N01/MF N01.

This bibliography contains citations concerning preparation, properties, and applications of ion-exchange resins. Applications include water and waste treatment; chemical recovery, separation, purification, and catalysis; desalination; and ore treatment and recovery. Regeneration and disposal of ion-exchange resins are also covered. (This updated bibliography contains 430 citations, none of which are new entries to the previous edition.)

13244 **(PB—89-852883/XAB) Ion-exchange resins. January 1988-December 1988 (Citations from the COMPENDEX data base). Report for January 1988-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 105p. NTIS PC N01/MF N01.

Supersedes PB—88-857719.

This bibliography contains citations concerning preparation, properties, and applications of ion-exchange resins. Applications include water and waste treatment; chemical recovery, separation, purification, and catalysis; desalination; and ore treatment and recovery. Regeneration and disposal of ion-exchange resins are also covered. (This updated bibliography contains 174 citations, all of which are new entries to the previous edition.)

13245 **(Y/DK—606) An automated autosampler system developed for the quantitative analysis of mercury in environmental samples.** Hanzelka, C.C.; Berlinski, P. (Oak Ridge Y-12 Plant, TN (USA)). 11 Jan 1989. Contract AC05-84OS21400. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005730/JAW.

A 69-position, 300-mL bottle autosampler has been designed and is currently being used to automate a flameless atomic absorption (AA) spectrophotometer. The autosampler performs repetitive operations that have normally been performed by the laboratory analyst. The unit has "freed" the analyst to perform other necessary tasks during sample analysis. A computer controls the operation of the unit and performs necessary data acquisition. 2 refs., 2 figs.

13246 **Size-exclusion chromatography system for macromolecular interaction analysis.** Stevens, F.J. (to Dept. of Energy, Washington, DC). US Patent 4,762,617. 9 Aug 1988. Filed date 15 Jan 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a method for measuring the interaction between first and second macromolecular solutes in forming a complex, the method comprising: depositing the first and second solutes in a chromatographic column at a first location therein; measuring the concentrations of unreacted portions of the first and second solutes as well as the concentration of a complex formed by the first and second solutes at a second location in the chromatographic column; taking the difference between the concentration of the complex and the sum of the concentrations of the first and second solutes in generating an experimental delta function; generating simulated delta functions corresponding to a range of association coefficients representing a range of degrees of interaction between the first and second solutes under various conditions; comparing the experimental delta function with the simulated delta functions; and correlating the measured concentrations of the first and second solutes with the range of association coefficients in providing a quantitative measure of the interaction between the first and second solutes.

4002 Inorganic, Organic And Physical Chemistry

REFER ALSO TO CITATION(S) 12509, 12522, 12529, 12576, 12587, 12604, 12619, 12657, 13169, 13175, 13178, 13200

13247 **(AD-A—199600/8/XAB) Biodetector of organophosphorous and other nerve agents. Contractor report, May 1984-July 1987.** Eldefrawi, M.E.; Valdes, J.J. (Maryland Univ., Baltimore (USA). School of Medicine). Sep 1987. 46p. NTIS, PC A03/MF A01.

The nicotinic ACh receptor obtained from the electric organ of Torpedo was used successfully to detect OP nerve agents but had low sensitivity for cyanide and sulfur mustard. Use of ACh receptor-regulated binding of the allosteric probe was more efficient than monitoring changes in fluorescent receptor complexes. The most-effective and practical strategy for developing a biodetector of nerve agents was to pursue receptor-based capacitance biosensors. The receptor embedded in lipid bilayer was interfaced with a microsensor and its activation by ACh increased the capacitance and this was inhibited by curare. The ACh-receptor-based biosensor was very sensitive in detecting the effects of OP nerve agents on receptor responses. The preliminary success that was achieved with the ACh-receptor-based biosensor establishes the principle and suggests that other receptors should also work to detect a wide variety of toxicants. A receptor-based biodetector is no longer simply a hypothesis but is a reality and a practical one can be developed.

13248 **(AD-A—199816/0/XAB) Graph theoretical and topological approach to chemical structure, reactivity, and dynamics. Final report, 15 May 1984-30 September 1988.** King, R.B. (Georgia Univ., Athens (USA). Research Foundation). Oct 1988. 28p. NTIS, PC A03/MF A01.

This report summarizes work done by the mathematical chemistry group at the University of Georgia during the period 1984-1988 on applications of graph theory, topology, and group theory to problems in the areas of chemical structure, chemical reactivity, and chemical dynamics. Applications of these theoretical methods to superconductivity, surface science, fuel design, medicine, and environmental technology have been identified. A list of 108 publications arising from this project has been appended. Keywords: Metal clusters, Superconductors, Polyhedra, Symmetry, Molecular connectivity, Fractals, Recurrence relations. (AW)

13249 **(AD-A—199854/1/XAB) Thermal stress imposed by prototype bilayer and current ground crew chemical defense ensembles: a limited laboratory comparison. Final report, 30 June 1986-1 January 1987.** Krock, L.P.; Navalta, R.; Myhre, L.G. (School of Aerospace Medicine, Brooks AFB, TX (USA)). Jul 1988. 20p. (USAFSAM-TR—88-7). NTIS, PC A03/MF A01.

An open bilayer ground-crew chemical defense ensemble (CDE) was proposed to reduce the thermal burden during vapor-only exposure periods. This study compared the thermal-stress profile of the proposed ensemble to that produced by the currently employed closed CDE. Four subjects, alternating ensembles on separate days, walked on a treadmill in an environmental chamber at 5.3 km/h (3.3 mph) and 2% grade (an energy expenditure of 350 kcal/h) for alternating work/rest to achieve significant recovery. Mean total sweat production was lower (1.38 vs. 2.50 liters) and percent sweat evaporation greater (65.7% vs. 30.0%) in the prototype ensemble than in the CDE. The prototype ensemble provided greater heat dissipation and allowed more-efficient sweat evaporation which had the double benefit of reducing heat storage and limiting dehydration.

13250 **(AD-A—200102/2/XAB) Development of paper, chemical agent detector, 3-way liquid containing non-mutagenic dyes. I. Replacement of the yellow dye thiodiphenyl-4,4′-diazo-bis-salicylic acid (A2).** Thoraval, D.; Bovenkamp, J.W.; Bets, R.W.; Dix, J.K. (Defence Research Establishment, Ottawa, Ontario (Canada)). Jun 1988. 41p. (DREO—962). NTIS, PC A03/MF A01.

The Paper, Chemical Agent Detector, 3-Way Liquid is used by the Canadian Forces for the detection of liquid chemical warfare agents and is supplied to many Western countries.

Unfortunately, two of the three dyes used in the detector paper have been found to be mutagenic and thus project was initiated to find non-mutagenic replacement dyes. This report describes the work leading to the replacement of dyestuff A2, which is currently used to detect G-type nerve-agent liquid droplets. Candidate replacement dyes were either procured commercially or synthesized when not available commercially. Two good, non-mutagenic, replacement dyes for A2 were found, namely Disperse Yellow 23 and p-ethoxyphenyl-azo-alpha-hydroxynaphthoic acid. These dyes were incorporated into paper, both alone and in the presence of the dyes used for detection of mustard and V-tape nerve agents. Various dye loadings were used. Based on the results obtained, Disperse Yellow 23 was recommended as the replacement for the current dye A2. This dye gave brighter yellow responses than A2 and the other candidate replacement dye. Detector paper made with this dye is capable of detecting smaller droplets of G-type nerve agents.

13251 **(CONF-880767—3) Exciplex formation and electron transfer in polychromophoric systems.** Yang, N.C.; Minsek, D.W.; Johnson, D.G.; Wasielewski, M.R. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 7p. NTIS, PC A02 - OSTI. Order Number DE89005826/JAW.

From 7. international conference on photochemical conversion and storage of solar energy; Evanston, IL, USA (31 Jul 1988).

The rates of excited anthracene decay and intramolecular exciplex formation from bichromophoric molecules containing an anthryl group and an amine donor vary with the length of the chain link, the nature of the amine donor and the viscosity of the medium. The results indicate that the intramolecular exciplex formation may proceed via more than one pathway. Our recent experimental results suggest that electron transfer from the amino donor to the excited anthryl group may play a role in the exciplex formation in viscous alkanes.

13252 **(DOE/ER/13159—3) Use of functionalized surfactants in flame atomic analysis: Final technical report.** Armstrong, D.W. (Texas Tech Univ., Lubbock (USA). Dept. of Chemistry and Biochemistry). [1987]. Contract AS05-84ER13159. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006043/JAW.

Research results in the following areas are briefly summarized: basic properties of surfactants, micelles, and cyclodextrins as they relate to chemical analysis; use of functionalized surfactants, micelles, and cyclodextrins in spectroscopic analysis; macromolecular separation theory and mechanism; use of functionalized surfactants and cyclodextrins in separations; capillary work for future coupling of spectroscopic and LC projects. (CBS)

13253 **(DOE/ER/13289—5) Model heteroatom removal reactions on molybdenum surfaces: Technical progress report.** Friend, C.M. (Harvard Univ., Cambridge, MA (USA). Dept. of Chemistry). 1987. Contract FG02-84ER13289. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004995/JAW.

The reactions of heteroatom-containing molecules on Mo(110) have been investigated under ultra-high vacuum in order to understand the mechanistic details of catalytic heteroatom removal reactions. The experimental approach of this work is to perform comparative studies of a series of structurally related molecules in order to determine how a specific property, such as the C-X (X{double←bond}S, N or O) bond strength effects reaction selectivity and kinetics. Surface intermediates are identified and structurally characterized using several complementary spectroscopic methods: X-ray photoemission, high resolution electron energy loss, near edge x-ray absorption fine structure (NEXAFS), Auger electron and temperature programmed reaction spectroscopies. Results are summarized in this document. 21 refs., 2 figs.

13254 **(DOE/ER/13430—4) [Reductive coupling of carbon monoxide to C_2 products]: Progress report.** Templeton, J.L. (North Carolina Univ., Chapel Hill (USA)). 29 Dec 1988. Contract FG05-85ER13430. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005727/JAW.

Chemical preparation of transition element carbyne complexes is discussed. Particular reference is made to tungsten and tantalum complexes. Reaction kinetics are addressed. (CBS)

13255 **(DOE/ER/13605—T1) [Heats of formation, structure and heteroatom NMR studies of organosulfur molecules]: Summary of progress, 1986--1987: Final technical report.** (North Carolina Univ., Chapel Hill (USA)). [1988]. Contract FG05-86ER13605. 31p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005262/JAW.

It has only been 12 months since the grant was funded. During this time we have purchased a new AT type of computer and have transposed most of our software from BASIC into ASSYST, which is a much more powerful language for data analysis and display. In addition, we have carried out investigations on the dissociation dynamics of three ionic systems. These are the production of $C_7H_7^+$ ions from a variety of precursor molecules; the dissociation of butylhalide ions ($C_4H_9X^+$, X = Cl, Br, and I); and the dissociation paths of butylalcohol ions ($C_4H_9OH^+$). Finally, we have spent considerable time in designing a refocusing mirror for our new PEPICO apparatus. This mirror is now ordered and the construction of the new apparatus is well underway. What follows here is a brief review of the past year's findings. This work deals primarily with ionic systems. However, the neutral precursors and neutral dissociation products are also of great interest. In fact, the proposed research for the coming three years is aimed as much at the chemistry and thermochemistry of the neutral molecules and radicals as it is on the ionic species. Proposed research is also reviewed. 43 refs.

13256 **(DOE/ER/13678—16) Thermodynamics of mixed micelle and mixed monolayer formation and solubilization of N-alcohol in the mixed micelles.** Nguyen, Cuong Manh. (Oklahoma Univ., Norman (USA). School of Chemical Engineering and Materials Science). 1987. Contract FG05-87ER13678. 235p. NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005143/JAW.

A new method of calculating the composition of mixed micelle and mixed monolayer in equilibrium with monomer of known composition is proposed. The Gibbs-Duhem equation and the pseudo-phase separation model were used in the proposed method. The method needs only CMC data and the monomer concentrations at the standard state surface tension as a function of monomer composition, but is limited to binary surfactant systems. The proposed methodology is applied to cationic/cationic, cationic/nonionic, and anionic/nonionic surfactant pairs. 156 refs., 68 figs., 7 tabs.

13257 **(DOE/ER/13781—1) Studies of supported hydrodesulfurization catalysts: Progress report for September 1, 1987 to December 31, 1988.** Hercules, D.M. (Pittsburgh Univ., PA (USA). Dept. of Chemistry). Oct 1988. Contract FG02-87ER13781. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004479/JAW.

The objectives of the proposal are: (1) to study the mechanism of adsorption of anions pertinent to HDS catalysts (Mo,W) on Al_2O_3 (or TiO_2) surfaces, (2) to determine the distribution of Mo (or W) oxidation states in Mo (or W)/TiO_2 (or Al_2O_3) catalysts on reduction and to correlate Mo oxidation state to the catalytic activity observed for various probe reactions, (3) to apply the methodology for quantitative analysis of the distribution of supported species by Laser Raman Spectroscopy (LRS) (developed from an early study of Mo/TiO_2 catalysts) to other systems relevant to HDS catalysts (e.g., W/TiO_2), and finally (4) to correlate the Mo (or W) speciation derived from LRS with HDS activity. The accomplishments of the past year are as follows: We have investigated the nature of the interaction of molybdate and tungstate with alumina by comparing their adsorption behavior with that of perrhenate and permanganate anions; We have monitored by ESCA and gravimetric analysis the changes in Mo oxidation states for Mo/TiO_2 catalyst as a function of reduction conditions. The results were correlated with benzene hydrogenation activity. We have extended the methodology for quantitative analysis of the distribution of supported species by LRS to the W/TiO_2 system. Finally, we have corre-

lated the Mo speciation in Mo/TiO_2 derived from LRS with HDS activity.

13258 **(DOE/ER/13864—1) Vibrational spectroscopic studies of surface chemical interactions in chemisorption and catalysis: Annual progress report.** Yates, J.T. Jr. (Pittsburgh Univ., PA (USA). Dept. of Chemistry). 31 Dec 1988. Contract FG02-88ER13864. 3p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005896/JAW.

Vibrational spectroscopy, applied to the study of surface chemistry, is able to give detailed information about the structure and interactions of surface species at a level of sensitivity which is unrivaled by most other surface measurement methods. This work utilizes three different vibrational spectroscopic methods to study surface chemistry on both single crystal and supported metal catalyst surfaces. These methods are: (1) Reflection IR Spectroscopy, (2) Transmission IR Spectroscopy, and (3) High Resolution Electron Energy Loss Spectroscopy (HREELS). Current activities include the construction of a novel FT Reflection IR Instrument with rapid background acquisition and subtraction procedures. Transmission ir studies on the behavior of absorbed hydrocarbon species are underway in a unique high temperature-low temperature cell. Here, an unusual lability of C-H bonds from butadiene-derived species on Rh has been observed spectroscopically. HREELS studies of model oxide-supported metal catalysts have been initiated and promise to give unique information about the nature of metal-support interactions.

13259 **(DOE/ER/13914—12) Interfacial systems for photochemical energy conversion: Progress report.** Wrighton, M.S. (Massachusetts Inst. of Tech., Cambridge (USA)). 1988. Contract FG02-88ER13914. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005007/JAW.

The following research areas are briefly discussed: excited state electron transfer in multi-component redox molecules; pH-dependent rectification in viologen-quinone polymers; selective modifications of II-IV semiconductors; and electrocatalysis of redox processes with biological molecules. 13 refs. (CBS)

13260 **(DOE/PC/90526—T1) Partial oxidation of light alkanes in transition-metal ion containing zeolites: [Quarterly report for the period September 15, 1988--December 15, 1988].** Klier, K.; Lange, J.P. (Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry). [1988]. Contract FG22-86PC90526. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004675/JAW.

Preliminary ab-initio calculations of the electronic structure of transition-metal ions in zeolites are reported. The planar trigonal $[Cu(H_2O)_3]^{2+}$ and $[Fe(H_2O)_3]^{2+}$ clusters were calculated using basis sets of the types STO-3G and STO3-21G. The calculations usually had a difficult convergence, and they resulted in erroneous electronic structure. The energy of the valence band edge, calculated around {minus}23 eV, was about twice as large as the ionization energy of water. Furthermore, the position of the 3d levels did not have the right degeneracy and could not account for the electronic transition observed in Cu^{2+}-A and Fe^{2+}-A zeolites. Those errors may be due to the inadequately chosen coordinate systems that does not take advantage of the cluster symmetry. More effort is required in this direction.

13261 **(IC—88/191) On the dimerization of linear polymers.** Aragao Carvalho, C. de. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705341/JAW.

We use the continuum limit of the Su-Schrieffer-Heeger model for linear polymers to construct its effective potential (Gibbs free energy) both at zero and finite temperature. We study both trans and cis-polymers. Our results show that, depending on a renormalization condition to be extracted from experiment, there are several possibilities for the minima of the dimerized ground state of cis-polymers. All calculations are done in the one-loop approximation. (author). 16 refs, 3 figs.

13262 **(INIS-mf—11331) SASTA 3.** (Southern Africa Thermal Analysis Society (South Africa)). 1988. 29p. (CONF-8802128—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705188/JAW.

From 3. Southern African symposium on thermal analysis; Cape Town, South Africa (2 Feb 1988).

During the last twenty years and particularly over the last decade thermal analysis (TA) has moved through phases of consolidation and recognition followed by major expansion. The Southern Africa thermal analysis society held by third Southern Africa symposium on thermal analysis from 2-3 Feb 1988 in Cape Town. At this conference several papers were delivered on the different aspects of thermal analysis which included: thermal behaviour, thermal decomposition, thermogravimetry, thermal reactions as well as trends, methods and applications of thermal analysis.

13263 (INIS-mf—11331, pp 20) **Fundamental study of the solid state reduction of V/sub 2/ O/sub 5/.** Albasini, F.; Van Vuuren, C.P.J. (Council for Mineral Technology, Randburg (South Africa); Pretoria Univ. (South Africa)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705188/JAW. (CONF-8802128—).

From 3. Southern African symposium on thermal analysis; Cape Town, South Africa (2 Feb 1988).

13264 (INIS-mf—11331, pp 8) **Thermal behaviour of some uranium (IV) nitrates.** Strydom, C.A.; Van Vuuren, C.P.J. (Pretoria Univ. (South Africa)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705188/JAW. (CONF-8802128—).

From 3. Southern African symposium on thermal analysis; Cape Town, South Africa (2 Feb 1988).

13265 (INIS-mf—11331, pp 9) **Thermal decomposition of U/sub 2/F/sub 9/ and α-UF 5.** Carstens, P.A.B.; Hudson-Lamb, D.L. (Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705188/JAW. (CONF-8802128—).

From 3. Southern African symposium on thermal analysis; Cape Town, South Africa (2 Feb 1988).

13266 (INIS-mf—11331, pp 11) **Thermal decomposition and kinetics of UCL/sub 4/.3dmso.** Wagener, J.B.; Van Vuuren, C.P.J. (Pretoria Univ. (South Africa)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705188/JAW. (CONF-8802128—).

From 3. Southern African symposium on thermal analysis; Cape Town, South Africa (2 Feb 1988).

13267 **EXAFS analysis of ionomers.** Ding, Y.S.; Pan, H.K.; Register, R.A.; Cooper, S.L. (Xerox, Inc., Webster Research Center, Webster, NY (US));. pp v of Scattering, deformation, and fracture in polymers. Wignall, G.D.; Crist, B.; Russell, T.P.; Thomas, E.L. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Extended x-ray absorption fine structure (EXAFS) spectroscopy has been successfully applied to the analysis of the ionic domain microstructure in zinc and rubidium neutralized ionomers. In dehydrated zinc neutralized ionomers, the zinc cation was found to be tetrahedrally coordinated to oxygen atoms. For ionomers with hydrocarbon backbones, these oxygen atoms may originate from the sulfonate or carboxylate groups. For ionomers with perfluorinated backbones, some of the oxygen atoms may be ascribed to water coordination as well. In fully hydrated zinc neutralized ionomers, the zinc cation exists as Zn(H/sub 2/O)/sub 6//sup 2+/. In contrast, the fully hydrated monovalent rubidium neutralized ionomers exhibited a highly disordered environment about the cation.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 12527

13268 **(AD-A—200301/0/XAB) In-situ infrared study of the oxidation of SO_2 on platinum electrodes. Technical report No. 93, September 1987-July 1988.** Koreniewski, C.; McKenna, W.; Pons, S. (Utah Univ., Salt Lake City (USA). Dept. of Chemistry). 15 Jul 1988. 21p. NTIS, PC A03/MF A01.

The oxidation of sulfur dioxide on metal electrodes is of interest for its application in a variety of industrial processes, particularly in operations involving degradation of automobile emissions, production of energy, and winning of sulfide ores. The oxidation of sulfur dioxide by electrochemical methods is a complex process in which intermediates and products are formed that strongly adsorb on the electrode surface. A large number of electrochemical investigations have appeared that employ voltammetric techniques to obtain mechanistic information about the process. However, the oxidation process at platinum electrodes is a strong function of electrode pretreatment at cathodic potentials; thus, the electrochemical studies are not all in agreement.

13269 **Solubility of NiO in molten Li/sub 2/CO/sub 3/, Na/sub 2/CO/sub 3/, K/sub 2/CO/sub 3/, and Rb/sub 2/CO/sub 3/ at 910°C.** Orfield, M.L.; Shores, D.A. (Dept. of Chemistry, Univ. of Wisconsin Stout, Menomonie, WI (US));. *Journal of the Electrochemical Society;* **135**: No. 7, 1662(Jul 1988).

The solubility of NiO in molten Li/sub 2/CO/sub 3/, Na/sub 2/CO/sub 3/, K/sub 2/CO/sub 3/, and Rb/sub 2/CO/sub 3/ was measured at 910°C as a function of the basicity or -log α(O/sup 2-/) of the salt. The basicity was controlled by varying the rhoCO/sub 2/ in the gas phase above the melt. Acidic and basic dissolution were observed in all salts except Li/sub 2/CO/sub 3/, which underwent only basic dissolution. The slopes of the solubility lines in both acid and basic regime were related to the dissolution products where possible. The dependence of NiO solubility on the activity of O/sub 2/ in the system was determined for both regimes of all the melts.

4005 Photochemistry

REFER ALSO TO CITATION(S) 12532, 13259

13270 **(DOE/ER/13590—3) Multiphoton ionization spectroscopy and photochemistry of transient species: Progress report, July 15, 1986--January 15, 1989.** Johnson, P.M. (State Univ. of New York, Stony Brook (USA)). Jan 1989. Contract FG02-86ER13590. 23p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006248/JAW.

The work funded by the Department of Energy is primarily concerned with the resonance ionization spectroscopy of small molecules and radicals. During this grant period we have examined the electronic spectra of several diatomic and triatomic molecules with a view toward the better understanding of their electronic structure and photochemistry, as well as the development of the tool of resonance ionization spectroscopy for such practical applications as the detection of trace species. We have also done some work on the photophysics of the multiphoton ionization process, using argon as the test system. The molecules chosen for study all have the common property that they do not fluoresce from states in the selected energy region, and their absorption spectra for these states is either forbidden or greatly obscured by the continuous absorption of dissociating states. Resonance ionization spectroscopy is valuable in that it can probe the absorptions of high lying states and that it discriminates against rapidly dissociating states, allowing the weaker but more stable states to make themselves known. The molecules for which substantial results have been obtained during this grant period are metastable nitrogen, iodine, carbon monochloride, and carbon dioxide. The first and last of these are not chemically stable and are formed by an electric discharge in a supersonic beam, while the other two, although chemically stable in the ground state, dissociate easily in the excited state and pose a challenge for spectroscopy because of their diffuse spectra.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 13185, 13186

13271 **(RCM—01288) Investigations on the evaluation of the long term radiation resistance of polymers in dependence on the irradiation conditions. Final report.** Menhofer, H.; Opp, D.; Zluticky, J.; Heusinger, H. (Technische Univ. Muenchen, Garching (Germany, F.R.). Lehrstuhl fuer Radiochemie; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1988. 223p. (In German). Technische Univ. Muenchen, Garching (Germany, F.R.). Inst. fuer Radiochemie.

The radiation resistance of polysiloxanes, polytetrafluorethylene, ethylenvinylacetate-copolymers, acrylonitrile-butadiene-copolymers and hydrated acrylonitrile-butadiene-copolymers was investigated. The radiation-induced changes of the mechanical properties and the crosslinking density were determined. Irradiation of compressed or strained samples showed, that irradiation has a marked influence on the residual deformation. Investigation of the radiation-induced changes in dependence of temperature showed, that in limited temperature regions the activation energies for the reactions can be evaluated applying the Arrhenius equation. For silicones the radical intermediates could be identified using the ESR-spintrap-technique. The radiation-induced changes of the segment mobility were evaluated applying the ESR-spinprobe-technique, the changes in crosslinking density were deduced from swelling measurements and the formation of oxydation-products was determined by IR-spectroscopy and gaschromatography-mass-spectrometry coupling. This made it possible to find correlations between segment mobility, crosslinking and other structural changes in the polymer. (orig.) With 31 figs., 9 tabs., 187 figs.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 12650, 12656, 12657, 13233, 13264, 13265, 13266, 13296, 13297, 13637, 13874

13272 **(CEA-CONF—9446) Actinide dioxide dissolution in acidic media: study of the mechanism by carbon paste electrochemistry and /sup 18/O labelling.** Berger, P.; Madic, C.; Livet, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). 1988. 2p. (CONF-8804200—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754929/JAW.

From 18. actinide meeting; Paris, France (20 Apr 1988).

13273 **(FRNC-TH—3375) Synthesis of high specific activity tritium labelled compounds.** Parent, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Biologie; Conservatoire National des Arts et Metiers (CNAM), 75 - Paris (France)). 1986. 101p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756677/JAW.

Tritiated methyl iodide of high specific activity is synthetized by Fischer-Tropsch reaction of tritium with carbon monoxide, tritiated methanol obtained is reacted with hydriodic acid. It is used for the synthesis of S-adenosyl L-methionine /sup 3/H-methyl and of diazepam /sup 3/H-methyl derivatives. Synthesis of 3-PPP/sup 3/H: (hydroxy-3 phenyl)-3N-n propyl [/sup 3/H-2.3] piperidine [/sup 3/H-2.3] with a specific activity of 4.25 T Bq/mM (115 Ci/mM) and of baclofene /sup 3/H with a specific activity of 0.925 TBq (25 Ci/mM) are also described.

13274 **(JAERI-M—88-167) Preparation of zirconium molybdate gel for /sup 99m/Tc gel generator.** Aliludin, Z.; Ohkubo, Masatake; Kushita, Kouhei. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Sep 1988. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756568/!AW.

Zirconium molybdate gel has excellent characteristics for use as column matrix material of /sup 99m/Tc generators. In this work, zirconium molybdate gels were prepared under different conditions;

pH's of molybdate solutions from 2.5 to 7.0, Mo:Zr molar ratios from 0.7:1.0 to 1.3:1.0, drying temperatures from an ambient temperature to 200 deg C, and drying times from 1 h to 25 h. Contents of water, nitrate, molybdenum and zirconium were measured to examine the fundamental conditions in gel preparation. The Mo:Zr molar ratio was 1.0:1.0 for the most of gels obtained. A /sup 99m/Tc generator was prepared with an amorphous zirconium molybdate containing a tracer level of /sup 99/Mo as column matrix material. Elution of /sup 99m/Tc was rapid and the average elution efficiency was 90 % for 6 ml elutions. Contents of radionuclidic impurities, Zr and Mo in the eluates, were low enough to meet the pharmacopoeia requirements for human use.

13275 **(JAERI-M—88-168) Studies on tritium separation by selective laser excitation of molecules.** Suzuki, Kazuya; Yokoyama, Atsushi; Fujisawa, Ginji; Ishikawa, Niro; Iwasaki, Matae. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Sep 1988. 102p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756569/JAW.

For separation of tritium from water, formaldehyde (HDCO/H/sub 2/CO) was irradiated by excimer laser (XeCl), dichloromethane (CDTCl/sub 2//CD/sub 2/Cl/sub 2/) by carbon dioxide laser and chloroform (CTCl/sub 3//CHCl/sub 3/) by ammonia laser. The maximum T/H separation factor 570 was obtained in the case of chloroform. Tritium exchange reaction between water (HTO) and chloroform (CHCl/sub 3/) was also examined. The reaction rate increased with increasing OH/sup -/ ion concentration in water. Based on the experimental results obtained, the isotope exchange - laser separation process of tritium was discussed. The number of steps of mixer-setter for tritium exchange reaction was calculated and a basic design of irradiation system was proposed. The electric power necessary for laser separation was compared with that for water distillation. To set up a efficient laser separation system utilizing multiphoton dissociation, the laser threshold energy of dissociation of a working molecule (or saturation fluence) was found to be the most important of several factors.

13276 **(LA-UR—88-3539) ^{13}C and ^{1}H NMR studies of PQQ and selected derivatives.** Houck, D.R.; Unkefer, C.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-8809195—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003616/JAW.

From 1. international symposium on PQQ and quinoproteins; Delft, Netherlands (5 Sep 1988).

The ortho-quinone structure of pyrroloquinoline quinone (PQQ) is famous for its reactivity with nucleophilic species of carbon, nitrogen, and oxygen(Duine et. al. 1987). In fact, the crystal structure of PQQ was solved in the form of the C-5 acetone adduct(Salisbury et. al 1979). The propensity of the ortho-quinone to accept nucleophiles is the chemical basis of the function of PQQ at enzyme active sites. The present study focuses on the NMR of PQQ and various derivatives formed with oxygen and nitrogen nucleophiles. Our goals are to assign the ^{1}H, ^{13}C, and ^{15}N NMR spectra and to rigorously confirm the structures of the adducts. Once the NMR data of the relevant adducts are well defined, we will use ^{13}C and ^{15}N labeled substrates to probe the active sites of PQQ containing enzymes. 7 refs., 2 figs., 1 tab.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 12753, 12758, 13365

13277 **(AD-A—200273/1/XAB) Investigation of fuel-additive effects on sooting flames. Annual technical report, 1 June 1987-31 May 1988.** Bonczyk, P.A. (United Technologies Research Center, East Hartford, CT (USA)). 30 Jun 1988. 16p. (UTRC/R—88-957464-A). NTIS, PC A03/MF A01.

The objective of this research is to clarify the mechanisms responsible for the suppression of soot in flames by fuel additives. Measurements are limited to well-defined hydrocarbon air prevaporized liquid- and gaseous-fueled flames. Gas-phase hydrocarbon species measurements were made in an axisymmetric prevaporized iso-octane/air diffusion flame with and without ferrocene present as a fuel additive. The concentrations have been determined using quartz probe sampling and chromatographic analysis. Of the roughly twenty species detected, most were unaffected by the ferrocene. Expections were C_2H_2 and H_2 which showed a decrease and increase, respectively, with ferrocene seeding. Solid effluent was collected and analyzed by ESCA (Electron Scattering for Chemical Analysis) for the seeded flame. For seeding levels sufficient to suppress a soot plume, the effluent was hematite.

13278 **(AD-A—200329/1/XAB) Digital imaging of laser-ignited combustion.** Seitzman, J.M.; Paul, P.H.; Hanson, R.K. (Stanford Univ., CA (USA). Dept. of Mechanical Engineering). Jun 1988. 7p. NTIS, PC A02/MF A01.

Pub. in AIAA Thermophysics, Plasmadynamics and Lasers Conference, 1-5(27-29 Jun 1988), AIAA-88-2775.

Ignition of combustible hydrocarbon and air mixtures by ultraviolet lasers was studied. Single-point time-resolved emission spectra and two- and three-dimensional laser-induced fluorescence images of the hydroxyl radical, OH, were recorded. Strong-line emission from carbon atoms and an anomalous enhancement in the carbon emission, 150-nsec after the ignition laser pulse, suggest the possible importance of resonance pumping of carbon atoms, possibly followed by photoionization, as an energy-deposition mechanism. The three-dimensional distribution measurements show the kernel to be cylindrically symmetric. The OH images also show a preferential growth of the ignition kernel in the direction of the incident laser.

13279 **(PB—89-122725/XAB) Development of a lattice gas model for the study of combustion. Final report.** Searby, G. (Laboratoire de Recherche en Combustion, Marseille (France)). 1988. 44p. (In French). NTIS, PC E04/MF E04.

The object of this research was to develop lattice-gas models in which two different species of particles would co-exist in interaction on a single lattice. Depending on the type of interaction and the intrinsic properties of each species, it is possible to consider the simulation of a mixing layer, the propagation of a constant-density chemical reaction front, or the propagation of a reaction front accompanied by heat release and a change of density. The report shows that it is possible to carry out realistic simulations of nonstationary two-dimensional constant-density reactive flows. It examines the destabilization of a shear flow (Kelvin-Helmholtz instability) with the formation of coherent structures and vortex coalescence. It also examines the effect of these structures on the reaction rate when the flow rate is moderate, high, or very high with respect to diffusion. When the flow rate is very high, a very substantial increase of the reaction time (25-fold) is observed with an intermittence phenomenon.

13280 **(PB—89-124358/XAB) Kinetic modeling of NOx formation and destruction and combustibles burnout. Final report, October 1985-August 1988.** Cole, J.A.; Kramlich, J.C.; Lanier, W.S. (Energy and Environmental Research Corp., Irvine, CA (USA)). Oct 1988. 453p. NTIS, PC A20/MF A01.

This report describes a model of the gas-phase chemistry involved in the combustion of simple hydrocarbon fuels and the interconversion of fixed nitrogen species. One focus of the work was on modeling the chemistry involved in reburning and other advanced NOx control strategies. A second focus was on the decay rate of various hydrocarbon species under high-temperature conditions. This provided an initial step toward the chemistry needed to model fuel burnout in small combustors; e.g., wood stoves. The approach was to compare rates for elementary reactions as represented in the different compilations available in the literature. Where inconsistencies appeared, the original literature on the rates was consulted. The mechanism was tested against benchmark data so that the key reactions that controlled any inconsistencies could be identified. Adjustments to the rates were allowed if they fell within the error bounds of the original determination.

13281 **(SAND—88-8004) Sandia combustion research program: Annual report, 1987.** Palmer, R.E.; Sanders, B.R.; Ivanetich, C.A. (eds.). (Sandia National Labs., Livermore, CA (USA)). 1988. Contract AC04-76DR00789. 245p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number TI89004344/JAW.

More than a decade ago, in response to a national energy crisis, Sandia proposed to the US Department of Energy a new, ambitious program in combustion research. Our strategy was to apply the rapidly increasing capabilities in lasers and computers to combustion science and technology. Shortly thereafter, the Combustion Research Facility (CRF) was established at Sandia's Livermore location. Designated a "User Facility," the charter of the CRF was to develop and maintain special-purpose resources to support a nationwide initiative--involving US universities, industry, and national laboratories--to improve our understanding and control of combustion. This report includes descriptions of several research projects which have been stimulated by Working Groups and involve the on-site participation of industry scientists. DOE's Industry Technology Fellowship Program has been instrumental in the success of some of the joint efforts. The remainder of this report presents research results of calendar year 1987, separated thematically into nine categories. Refereed journal articles appearing in print during 1987, along with selected other publications, are included at the end of Section 10. In addition to our "traditional" research--chemistry, reacting flow, diagnostics, engine combustion, and coal combustion--you will note continued progress in somewhat recent themes: pulse combustion, high temperature materials, and energetic materials, for example. Moreover, we have just started a small, new effort to understand combustion-related issues in the management of toxic and hazardous materials.

13282 **Concentration measurements of atomic hydrogen in subatmospheric premixed C/sub 2/H/sub 4//O/sub 2//Ar flat flames.** Salmon, J.T. (Lawrence Livermore National Lab., Livermore, CA (US)); Laurendeau, N.M. (Flame Diagnostics Lab., School of Mechanical Engineering, Purdue Univ., West Lafayette, IN (US));. *Combustion and Flame;* **74**: No. 3, 221-232(Dec 1988).

Absolute number densities of atomic hydrogen have been measured in subatmospheric, premixed C/sub 2/H/sub 4//O/sub 2//Ar flat flames via two-photon excited fluorescence. The fuel-equivalence ratios of the flames were 1.0 and 1.7. The fluorescence measurements are calibrated by partial equilibrium calculations and corrected for quenching effects by assuming a constant average cross-section and using kinetic energy. A sensitivity analysis of the calibration procedure reveals that slightly rich flames appear to be the best candidates for calibrating fluorescence measurements of atomic hydrogen by partial equilibrium.

13283 **A comparison of calculations of detonation pressures for a homologous series of polynitroaliphatic explosives by different equations of state.** Zerilli, F.J.; Doherty, R.M.; Short, J.M. (Naval Surface Warfare Center, White Oak Lab., Silver Spring, MD (US)); McGuire, R.R. (Lawrence Livermore National Lab., P.O. Box 808, Livermore, CA (US)); Kamlet, M.J. (Advanced Technology and Research, Inc., 14900 Sweitzer Lane, Burtonsville, MD (US));. *Combustion and Flame;* **74**: No. 3, 295-310(Dec 1988).

Detonation pressures of a homologous series of bis (2,2,2-trinitroethyl) alkanedioates, C(NO/sub 2/)/sub 3/CH/sub 2/-O-CO-(CH/sub 2/)/sub n/ x CO-O-C-(NO/sub 2/)/sub 3/, n = 0-15, are calculated by means of the Kamlet-Jacobs equation, the STRETCH-BKW computer code with RDX and TNT parameters, BKW(RUBY), BKWR, and JCZ-3. Calculations at a constant density of 1.7 g/cm/sup 3/ show that the BKWR code and the Kamlet-Jacobs equation track one another reasonably well, and that using STRETCH-BKW with either set of parameters predicts P/sub J/ to be almost invariant with oxygen balance. All of the calculational methods show reasonably similar variations of P/sub J/ with loading density. Effects of changing the assumed heat of formation of solid carbon are shown to be quite different for BKW(RUBY) and BKWR.

42 ENGINEERING

REFER ALSO TO CITATION(S) 12993, 14100

13284 **(LA-UR—88-4237) Laser working group.** Bigio, I.J.; Kurnit, N.A.; Donaldson, W.R.; Geissler, K.; Srinivasan-Rao, T. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-8810135—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005477/JAW.

From Switched-power workshop; Shelter Island, NY, USA (16 Oct 1988).

The laser working group considered options to deliver synchronized laser pulses of the required energy to the photocathode and laser triggered switches. These requirements actually decreased during the course of the workshop, and the values finally settled upon (<10 μJ in 100 fs at {approximately}250 nm for the photocathode and {approximately}10 mJ in 2 ps near either 250 nm or 1 μm for the switches) were considered to be well within the state of the art. Some development work may be required, however, to provide a system that has the desirable characteristics of stability, ease of use and low maintenance. 9 refs., 1 fig.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 12551, 12663, 13046, 13058, 13134, 13144, 13145, 13356, 13393, 13465, 13684, 14030, 14088

13285 **(AD-A—200534/6/XAB) Superconducting electronic-film structures. Semiannual report, 1 January-30 June 1988.** Braginski, A.I.; Gavaler, J.R.; Talvacchio, J. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 28 Jul 1988. 20p. NTIS, PC A03/MF A01.

Modification in Y-Ba-Cu-O growth procedures were instituted to eliminate non-superconducting near-surface layers observed in films. These include much higher ramp rates to the 850 C crystallization temperature of the as-deposited amorphous films and the use of an entirely in-situ processing. Films have now been grown that are superconducting up to the surface. Other Y-Ba-Cu-O films have been sputtered which are crystalline (tetragonal) as-deposited. These films. Gold layers deposited at room temperature on recent films were found to have contact resistance less than the limit of the apparatus sensitivity. Evidence for crystallinity and epitaxy was found in 10 nm YBCO films deposited at 650 C from the vapor phase. Measurements on superconducting resonator cavities have begun using epitaxial films on $SrTiO_3$ substrates. Thin epitaxial MgO layers were grown on sapphire to eventually provide a better substrate for this application. Y-Ba-Cu-O/MgO/Nb tunnel junctions were fabricated. Non-continuous barrier layer produced superconducting shorts in the junctions. This result, however, provided the non-ambiguous evidence that the new growth procedures had produced films that were superconducting up to the surface.

13286 **(AD-A—200587/4/XAB) Superconducting technology for electric propulsion. Master's thesis.** Keamy, E.F. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1988. 140p. NTIS, PC A07/MF A01.

This thesis analyzes the superconducting technology for a shipboard electric propulsion system. Superconductor operational operational limits, and magnet-design requirements were established. The magnetic-field requirements for a large-scale superconducting propulsion plant were analyzed from experimental information on copper and aluminum-stabilized NbTi superconductors. Experimental results were followed with a feasibility study in the conversion of a DD963 Spruance Class Destroyer from mechanical to superconducting electric drive. The results of the conversion are an increase in survivability, speed, usable deck area (4,954 ft^2, maintainability, propeller efficiency and endurance range (+71%) along with a decrease in displacement (-2.83%) and self-radiated noise without compromising existing mission capabilities. The estimated cost of the conversion is $118.8 million dollars.

13287 **(BNL—41685) Superconducting Tl-Ca-Ba-Cu-O thin films by reactive magnetron sputtering.** Chen, D.H.; Sabatini, R.L.; Qiu, S.L.; Di Marzio, D.; Heald, S.M.; Wiesmann, H. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 8p. (CONF-881002—41). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005649/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

Superconducting Tl-Ca-Ba-Cu-O thin films with T/sub c/ onsets of 115 K and T/sub c/ (R=O) of 95 K have been prepared by reactive magnetron sputtering using Tl, Cu and Ca/Ba metal targets. It was found that proper thallium content is crucial for obtaining a high transition temperature. Wet oxygen and a sealed gold tube with additional thallium compounds were used to reduce the loss of thallium during annealing. X-ray diffraction spectra show that films with the sharpest transition at 95 K are predominantly c-axis oriented. XANES also shows a preferred c-axis orientation for the superconducting film, while for a nonsuperconducting film the near edge structure suggests greater disorder. X-ray microprobe fluorescence measurements indicate that these films are close to the 2122 stoichiometry. Scanning electron microscopy on these films is also presented. 10 refs., 5 figs.

13288 **(DOE/CE/15292—T9) The CARRI-CEL Impact Breaker (VSI crusher): Final technical report.** (Carri-Cel Rock Breaker, Inc., Cleveland, TN (USA)). 16 Dec 1988. Contract FG01-86CE15292. 146p. NTIS, PC A07 - OSTI. Order Number DE89004757/JAW.

The CARRI-CEL Impact Breaker (CIB) is a vertical shaft impact crusher used in the processing and reduction of stone as well as other minerals and friable items such as glass. It achieves this by propelling the material into a breakage area where the material "explodes" along its natural fault lines from the impact forces. The purpose of this grant and study was for further research and development of the CIB and the Flex Break Rock Cell while demonstrating to aggregate producers the energy saving capabilities as well as the crushing capabilities in various quarries and types of rock throughout the country. This would in turn promote the use of this new energy saving technology in an industry whose methods have changed little in the past 80 years and where energy conservation is rare. In the past, plants were designed by picking a crusher that would produce the desired product at the desired tons per hour (TPH) rate, then just adding as much horsepower as it took to achieve that goal.

13289 **(DOE/CE/15387—T1) [Development of advanced models of the MCC full expansion (quiet) engine]: First quarterly report.** (Engine Research Associates, Inc., Fort Wayne, IN (USA)). [1988]. Contract FG01-88CE15387. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89001802/JAW.

This is the first quarterly report to the Department of Energy on the progress associated with the development of advanced models of the MCC full expansion (quiet) engine. These models will be evaluated in successive steps and eventually incorporated into a lawn mower for the purpose of commercializing the engine for small wheeled lawn and garden applications. During the first three months of the program (July 1 thru Sept 30), the Phase I design was basically completed with the exception of some engine/lawn mower interface hardware which will be completed during the final stages of the development program after we have selected a lawn mower deck. Rick Erickson, the design engineer for the program, completed the initial parts drawings utilizing the computer drafting system together with guidance from Fredrick Erickson, the program principal engineer and Jeff Erickson, who is in charge of manufacturing the engines. A miniature copy of these drawings is included in the appendix for your review.

13290 **(DOE/FTR—9004963) [Discussions with Reinhard K. Maix of Asea Brown Boveri, Oerlikon, Switzerland and Jean-Claude Puippe and Walter Saxer of Werner Fluehmann AG, Duebendorf, Switzerland, regarding generic superconductor cable testing, June 24--July 11, 1988]: Foreign trip report.** Greene, A.F. (Brookhaven National Lab., Upton, NY (USA)). 21 Jul 1988. Contract AC02-76CH00016. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004963/JAW.

Included in the trip report is a summary of the status of HERA superconductor dipole cable by ABB and information regarding conductor for the proposed new BNL cable test magnet. Werner Fluehmann, AG has proposed to copper plate bore tubes for the RHIC accelerator. Suggestions on evaluation of this vendor are given.

13291 **(DOE/NE/37968—5) Extracting depth by binocular stereo in a robot vision system.** Marapane, S.B.; Trivedi, M.M. (Tennessee Univ., Knoxville (USA). Dept. of Electrical and Computer Engineering). 1988. Contract FG02-86NE37968. 7p. (CONF-8808176—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005016/JAW.

From 10. conference on applications of digital image processing; San Diego, CA, USA (1 Aug 1988).

New generation of robotic systems will operate in complex, unstructured environments utilizing sophisticated sensory mechanisms. Vision and range will be two of the most important sensory modalities such a system will utilize to sense their operating environment. Measurement of depth is critical for the success of many robotic tasks such as: object recognition and location; obstacle avoidance and navigation; and object inspection. In this paper we consider the development of a binocular stereo technique for extracting depth information in a robot vision system for inspection and manipulation tasks. Ability to produce precise depth measurements over a wide range of distances and the passivity of the approach make binocular stereo techniques attractive and appropriate for range finding in a robotic environment. This paper describes work in progress towards the development of a region-based binocular stereo technique for a robot vision system designed for inspection and manipulation and presents preliminary experiments designed to evaluate performance of the approach. Results of these studies show promise for the region-based stereo matching approach. 16 refs., 1 fig.

13292 **(DP-MS—88-113) Flexible Robotic Entry Device for nuclear materials production reactor.** Heckendorn, F.M. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 7p. (CONF-881011—35). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005330/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

The Savannah River Laboratory (SRL) has developed and is implementing a Flexible Robotic Entry Device (FRED) for the nuclear materials production reactors at the Savannah River Plant (SRP). FRED is designed for rapid deployment into confinement areas of operating reactors to assess unknown conditions. A unique "smart tether" method has been incorporated into FRED for simultaneous bidirectional transmission of multiple video/audio/control/power signals over a single coaxial cable. 3 figs.

13293 **(DP-MS—88-145) Savannah River NIM [Nuclear Incident Monitor] system maintenance program.** McMahan, J.W.; Clayton, J.D.; Henderson, W.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant; Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 12p. (CONF-8809144—8). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005219/JAW.

From DOE criticality alarm system workshop; Richland, WA, USA (20 Sep 1988).

The Savannah River Plant (SRP) uses 260 Nuclear Incident Monitors (NIMs) of its own design to detect and alarm nuclear criticality. The in-house maintenance program includes routine field

testing, with central facility repair and calibration. A central file of malfunction and calibration data is maintained and analyzed to determine component reliability determination. 11 figs.

13294 **(EGG-M—42787) Canisters for PCDP [Prototypical Consolidation Demonstration Program] consolidated fuel.** Hart, S.R.; Williams, K.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1988. Contract AC07-76ID01570. 17p. (CONF-880601—50). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005407/JAW.

From American Nuclear Society annual meeting; San Diego, CA, USA (12 Jun 1988).

Through its Prototypical Consolidation Demonstration Program (PCDP), the Department of Energy (DOE) is developing production-scale fuel consolidation equipment to reduce the storage volume required in national storage facilities, i.e., the geologic repository or a monitored retrievable storage (MRS) facility. During 1989 and 1990, the equipment will be "cold" tested at the equipment contractor's facility. Later, a "hot" demonstration could be performed at the Idaho National Engineering Laboratory (INEL) using actual spent fuel assemblies obtained from utilities. The resulting consolidated fuel canisters would subsequently be stored at the INEL. This paper briefly discusses the national canister development efforts and canisters that have been used for US consolidation efforts to date. The paper then focuses on the consolidated fuel canisters currently under development for the PCDP. 12 refs., 6 figs., 1 tab.

13295 **(EPRI-NP—6229) Technical repair guidelines for the Limitorque Model SMB-000 valve actuator: Final report.** Myers, R.F.; White, M.L. (Electric Power Research Inst., Palo Alto, CA (USA); Advanced Technology Engineering Systems, Inc., Reston, VA (USA)). Jan 1989. 286p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89006023/JAW.

The purpose of this report is to provide a comprehensive maintenance document to improve the long range operational reliability of Limitorque motor-operated valve actuators. This Technical Repair Guide (TRG) for Limitorque Motor-operated Valve Actuators Model SMB-000 is intended to provide the power-producing industry with a technical methodology as a basic guideline and instructional tool for maintaining Limitorque actuator reliability and safety. The first step in the preparation of this report was to review the history of Limitorque valve actuators in power plant service. From this review it was evident that no industry-wide methodology existed to provide standardized technical guidance for integration of on-site maintenance, planning, engineering, and test programs for Limitorque actuators, but several utilities have similar programs in place. This TRG provides an engineering description of operation and prevalent failure mechanisms; a design overview; preventive and predictive maintenance guidelines; concise technical instructions and procedures; recommended spare parts to be stocked; and management and administrative aids. Included in this report are periodic maintenance criteria recommendations, standardized repair methods, and general overhaul guidelines. Periodic actuator failures and common human error discussions are included, together with a standardized method of determining root causes of actuator failure. The TRG is a comprehensive approach to providing assistance to personnel at all levels, who may have responsibilities or interests regarding Limitorque valve actuators. 141 refs., 125 figs., 6 tabs.

13296 **(INFO—0142-1-Rev.1) Radioisotope safety. Rules for working with radioisotopes in a basic laboratory.** (Atomic Energy Control Board, Ottawa, Ontario (Canada)). 1985. 2p. (In English, French). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705104/JAW.

French translation on one side of poster.

13297 **(INFO—0142-2-Rev.1) Radioisotope safety. Rules for working with radioisotopes in an intermediate laboratory.** (Atomic Energy Control Board, Ottawa, Ontario (Canada)). 1985. 2p. (In English, French). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705105/JAW.

French translation on one side of poster.

13298 **(INFO—0146-2) Verification of the performance of impact limiting FINS-II.** Torr, K.G. (Monserco Ltd., Mississauga, Ontario (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Sep 1986. 96p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705106/JAW.

Atomic Energy Control Board (AECB) repeated drop test experiments, by Oak Ridge National Laboratories (ORNL) in 1971, to: (a) investigate the influence of impact velocity in order to determine whether it was a cause of the difference between the two sets of curves, and (b) extend the range of application of the design curves; specifically to higher deformation, to stainless steel material, and to non-square (oblique) impact conditions. Using the same drop test facility, instrumentation and experimental procedure as the previous study, data were collected from 272 specimens. These were primarily of the single fin type, similar to the ORNL design; only the oblique impact test specimens had a special double fin configuration. Results from the impact velocity tests showed that while this did influence the shape of the first part of the curves, it did not explain the difference in magnitude between the two sets of curves. Changing the fin material to type 304 stainless steel showed that for vertical fins essentially the same curves were obtained. However, for the 30 degree inclined specimens, the stainless steel fins showed lower energy absorption capabilities. Measurements from the high deformation tests indicated that there is no tendency for the curves to change slope at the higher deformations. The oblique impact tests attempted to extend the application of the design curves to a 'one end first' type of container impact condition. Results confirmed expected higher values of deformation per input (energy/fin width), but there was no correlation between the curves for normal impact conditions and those for oblique impact conditions.

13299 **(INFO—0232) Ice plugging of pipes using liquid nitrogen.** Twigg, R.J. (Glencor Engineering Ltd., Nepean, Ontario (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Mar 1987. 37p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705134/JAW.

This report presents a study on the ice plugging of pipe using liquid nitrogen, and is based on a literature review and on discussions with individuals who use the technique. Emphasis is placed on ferritic alloys, primarily carbon steels, in pipe sized up to 60 cm in diameter and on austenitic stainless steels in pipe sizes up to 30 cm in diameter. This technique is frequently used for leak testing in nuclear facilities.

13300 **(JAERI-M—88-148) Preliminary study on the effect of the distribution of /sup 235/U fuel concentration on critical mass.** Katakura, Jun-ichi; Sakai, Tomohiro. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 17p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756560/JAW.

The nuclear criticality data compiled in handbooks and/or guides for nuclear criticality safety are usually assumed to have a constant fuel concentration through a fuel region. However, it may occur in fuel processing that fuel concentration is not a constant in a fuel region. It is known that minimum critical mass is reduced in high enriched fuel if the fuel is distributed in a sphere system as the concentration decreases with the radius. The reduction rate has been reported as 6 to 30 %, that is a large discrepancy. And also, for low enriched fuel, the effect of fuel distribution has not been satisfactly examied. Therefore, the effect of the distribution of /sup 235/U fuel concentration on critical mass was studied. It was confirmed from the study that the minimum critical mass is reduced about 7 % by the effect of the distribution for high enriched uranium fuel. For low enriched uranium fuel of 4 wt% enriched uranyl nitrate solution, the reduction of the minimum critical mass was not evident in our calculation. However, it became apparent that the critical mass is reduced for a region of fuel concentration below 700 gU/1.

13301 **(LBL—26177) Initial research regarding isothermal shear fatigue of solder joints.** McCormack, M.T. (Lawrence Berkeley Lab., CA (USA)). May 1988. Contract AC03-76SF00098. 35p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004654/JAW.

This work presents a versatile load frame apparatus constructed to provide the capabilities needed for performing isothermal shear fatigue of solder joints in a variety of thermal environments. Initial isothermal data from -55{degree}C to 125{degree}C gathered with 60Sn-40Pb and 5Sn-95Pb solder joints are then furnished to illustrate simple use of the apparatus. 15 refs., 15 figs.

13302 **(N—89-12398) Facility for interferometric testing of 1.25-m mirrors at liquid helium temperatures.** Salerno, L.J.; Melugin, R.K. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). Oct 1988. 14p. (NASA-TM—101017; A—88253; NAS—1.15:101017). NTIS, PC A03/MF A01.

A concept is presented for a national cryogenic optics test facility capable of optical characterization of 1.25 m diameter optics having focal lengths up to 6.2 m at temperatures from 300 K to near 4 K. The facility will be comprised of a large Dewar with a phase shift interferometer, a two stage vacuum system employing a turbomolecular pump, and an integral vibration isolation system. The entire facility will be housed in a concrete site with a massive floor to assist in reducing vibration during optical tests. By providing interchangeable sections, the overall height of the Dewar can be adjusted to provide for testing of shorter focal length optics. The background for the facility is discussed along with the facility location, and the requirements and the performance considerations which drive the Dewar design with respect to the vibration isolation system, vacuum system, and optical interferometry.

13303 **(N—89-12836) Mass flow meter using the triboelectric effect for measurement in cryogenics. Final report.** Bernatowicz, H.; Cunningham, J.; Wolff, S. (Visidyne, Inc., Burlington, MA (USA)). Apr 1987. 76p. (NASA-CR—179572; NAS—1.26:179572; SAIC—87/1612). NTIS, PC A05/MF A01.

The use of triboelectric charge to measure the mass flow rate of cryogens for the Space Shuttle Main Engine was investigated. Cross correlation of the triboelectric charge signals was used to determine the transit time of the cryogen between two sensor locations in a .75-in tube. The ring electrode sensors were mounted in a removable spool piece. Three spool pieces were constructed for delivery, each with a different design. One set of electronics for implementation of the cross correlation and flow calculation was constructed for delivery. Tests were made using a laboratory flow loop using liquid freon and transformer oil. The measured flow precision was 1 percent and the response was linear. The natural frequency distribution of the triboelectric signal was approximately 1/f. The sensor electrodes should have an axial length less than approximately one/tenth pipe diameter. The electrode spacing should be less than approximately one pipe diameter. Tests using liquid nitrogen demonstrated poor tribo-signal to noise ratio. Most of the noise was microphonic and common to both electrode systems. The common noise rejection facility of the correlator was successful in compensating for this noise but the signal was too small to enable reliable demonstration of the technique in liquid nitrogen.

13304 **(N—89-12837) Mass flow measurement of liquid cryogens using the triboelectric effect. Final report.** Dechene, R.L. (Auburn International, Inc., Danvers, MA (USA)). Aug 1986. 65p. (NASA-CR—179519; NAS—1.26:179519). NTIS, PC A04/MF A01.

A cross correlator technique using triboelectric technology has been shown to be a feasible method to measure liquid flow rate for liquid nitrogen and JP4 jet fuel. This technology, invented and pioneered by Auburn International, Inc., is also expected to be suitable for use with all other insulating liquids and cryogens. The technology described is particularly well suited for cryogenic use, since the sensor is non-contacting and non-intrusive, and therefore, causes no additional pressure drop within the flow stream. Further development of the in-line sensor is required to produce a prototypical version for the test purposes under SSME fuel flow conditions. However, with the knowledge gained from this feasibility study, it is very likely that an acceptable sensor design for a full test bed evaluation could be produced.

13305 **(N—89-12870) Dynamics of face and annular seals with two-phase flow. Final report, 15 March 1981-18 November 1988.** Hughes, W.F.; Basu, P.; Beatty, P.A.; Beeler, R.M.; Lau, S. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). Nov 1988. 270p. (NASA-CR—183352; NAS—1.26:183352). NTIS, PC A12/MF A01.

A detailed study was made of face and annular seals under conditions where boiling, i.e., phase change of the leaking fluid, occurs within the seal. Many seals operate in this mode because of flashing due to pressure drop and/or heat input from frictional heating. Some of the distinctive behavior characteristics of two phase seals are discussed, particularly their axial stability. The main conclusions are that seals with two phase flow may be unstable if improperly balanced. Detailed theoretical analyses of low (laminar) and high (turbulent) leakage seals are presented along with computer codes, parametric studies, and in particular a simplified PC based code that allows for rapid performance prediction: calculations of stiffness coefficients, temperature and pressure distributions, and leakage rates for parallel and coned face seals. A simplified combined computer code for the performance prediction over the laminar and turbulent ranges of a two phase flow is described and documented. The analyses, results, and computer codes are summarized.

13306 **(NUREG—0383-Vol.1-Rev.11) Directory of Certificates of Compliance for Radioactive Materials Packages: Report of NRC approved packages.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards and Transportation). Dec 1988. 491p. NTIS, PC A21/MF A01 - GPO - OSTI. Order Number TI89005713/JAW.

This directory contains a Report of the US Nuclear Regulatory Commission's Approved Packages (Volume 1), all Certificates of Compliance (Volume 2), and a Report of NRC Approved Quality Assurance Programs (Volume 3) for Radioactive Material Packages effective October 1, 1988. The purpose of this directory is to make available a convenient source of information on packagings which have been approved by the US Nuclear Regulatory Commission. To assist in identifying packaging, an index by Model Number and corresponding Certificate of Compliance Number is included at the front of Volume 2 of the directory. A listing by packaging types is included in the back of Volume 2. An alphabetical listing by Company name is included in the back of Volume 3 for approved QA programs. The Reports include a listing of all users of each package design and approved QA programs prior to the publication date of the directory.

13307 **(NUREG—0383-Vol.2-Rev.11) Directory of Certificates of Compliance for Radioactive Materials Packages: Certificates of Compliance.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards and Transportation). Dec 1988. 641p. NTIS, PC A99/MF A01 - GPO - OSTI. Order Number TI89005714/JAW.

This directory contains a Report of the US Nuclear Regulatory Commission's Approved Packages (Volume 1), all Certificates of Compliance (Volume 2), and a Report of NRC Approved Quality Assurance Programs (Volume 3) for Radioactive Material Packages effective October 1, 1988. The purpose of this directory is to make available a convenient source of information on packagings which have been approved by the US Nuclear Regulatory Commission. To assist in identifying packaging, an index by Model Number and corresponding Certificate of Compliance Number is included at the front of Volume 2 of the directory. A listing by packaging types is included in the back of Volume 2. An alphabetical listing by Company name is included in the back of Volume 3 for approved QA programs. The Reports include a listing of all users of each package design and approved QA programs prior to the publication date of the directory.

13308 **(RFP—4206) Comparison methods for nitrogen leak calibration.** Thomas, R.L. (ed.); Shain, D.I. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 7 Oct 1988. Contract AC04-76DP03533. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006390/JAW.

Two comparison measurement techniques were developed and tested by the Physical Metrology Laboratory at Rocky Flats for the calibration of nitrogen leaks. The first technique uses a simple rate-of-rise measurement, whereas the second is based upon comparison of ultimate pressures attainable within a well-defined vacuum chamber. Both methods were originated to provide a relatively fast and accurate means of leak rate determination, which is traceable to the Primary Standards Laboratory, Albuquerque, New Mexico. Theoretical and operational fundamentals of each method along with their test results are compiled. 2 refs., 3 figs., 3 tabs.

13309 **(SAND—88-0607C) Facility for the automatic spray painting of structural elements.** Duggins, B.D.; Goolsby, T.D.; Benham, R.A. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 14p. (CONF-890249—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003901/JAW.

From Robotics in aerospace; Anaheim, CA, United States (1 Feb 1989).

A process has been developed for remote controlled spray painting of structures of various sizes and shapes with a coating of sensitive explosive. The damaging effects of a hostile nuclear burst are simulated when the explosive layer is detonated. The process has evolved from a cumbersome, motor driven carriage assembly, to a facility which employs robotics and automatic positioning hardware. This paper will describe the hardware components which have been introduced into the facility and also the software which is used to control the spray application. The proper use of this hardware/software combination allows the design in advance of operations which deposit uniform or contoured thickness coatings onto complex shapes. 7 refs., 5 figs., 2 tabs.

13310 **(SAND—88-2251C) CAD directed robotic edge finishing.** Loucks, C.; Selleck, C.; Thunborg, S. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1988. Contract AC04-76DP00789. 20p. (CONF-890253—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005347/JAW.

From Deburring and surface conditioning; San Diego, CA, USA (14 Feb 1989).

The Robotic Edge Finishing Laboratory at Sandia National Laboratories is developing four areas of technology required for automated deburring and chamfering: (1) the automatic programming of robot trajectories and deburring processes using information derived from a CAD database, (2) the use of machine vision for locating the workpiece coupled with force control to ensure proper tool contact, (3) robotic deburring and machining of precision chamfered edges, and (4) in-process automated inspection of the formed edge. The Laboratory, its components, integration, and results from edge finishing experiments to date are described here. 18 refs., 9 figs.

13311 **(SAND—88-2625C) Force state mapping using experimental data.** Hunter, N.F. Jr.; Paez, T.; Gregory, D.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 18p. (CONF-890225—3). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number TI89001159/JAW.

From International modal analysis conference; Las Vegas, NV, USA (3 Feb 1989).

Nonlinear Systems present a significant challenge to current modal and vibration analysis techniques. One approach currently under investigation at a number of laboratories is the use of three dimensional maps of restoring force, velocity, and displacement. In this paper we discuss the background of force state mapping and apply the technique to experimental data from several single-degree-of-freedom systems. Possible extensions of the technique to multi-degree-of-freedom systems are introduced. Time and frequency domain techniques appropriate for parameter estimation for restoring force surfaces are described. 6 refs., 6 figs.

13312 **(SAND—88-2933) User guide to the Sandia shock compression database.** Kipp, M.E.; Grady, D.E.; Asay, J.R.; Graham, R.A. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1988. Contract AC04-76DP00789. 66p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005489/JAW.

This report documents search and retrieval procedures for the Sandia Shock Compression database. This database contains bibliographic data in the form of keywords and citation information for approximately 3000 papers in the area of shock compression of materials. Searches may be made on authors, keywords, and affiliations, and on some combinations. The database is managed by INGRES, and currently is installed on the Directorate 1500 VAX Cluster system. 1 ref.

13313 **(UCRL—21131) Structural details for wind design.** McDonald, J.R. (Lawrence Livermore National Lab., CA (USA); McDonald, Mehta and Minor, Consulting Engineers, Lubbock, TX (USA)). Nov 1988. Contract W-7405-ENG-48. 114p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006051/JAW.

The primary objective of this report is to present information and concepts that will aid the structural engineer in designing wind resistant buildings and structures. The concept of load path identification is presented, which urges the designer to carefully follow the path of the wind loads from building exterior through the structural system to the foundation. Potential weak links are identified along the load path. Details and practice of structural design will avoid weak links and potential failures are identified. 40 refs., 54 figs.

13314 **(UCRL—99753) A comparison of element-by-element preconditioned iterative methods for solid and structural mechanics.** Ferencz, R.M. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 21p. (CONF-8810262—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004777/JAW.

From Symposium on the solution of super large problems in computational mechanics; Mystic, CT, USA (18 Oct 1988).

Past work with element-by-element (EBE) preconditioned conjugate gradient iterative solution strategies has shown these techniques can be effective for large-scale, three-dimensional calculations in solid and structural mechanics. Significant gains over the profile storage direct solution method traditionally used in implicit finite element codes have been observed for a variety of real engineering analyses, especially in solid mechanics. Structural mechanics applications have proved less successful due to the ill-conditioned linear systems engendered by standard structural discretizations. This lack of robustness has recently motivated reconsideration of Lanczos-based algorithms as alternative iterative drivers. In this paper we compare the relative strengths of the conjugate gradient and Lanczos drivers when coupled with EBE preconditioning. The performance of the two methods is characterized, and compared with direct solution, using a model problem and a number of real engineering meshes. 26 refs., 14 figs., 2 tabs.

13315 **(WINCO—1058) A study of the Perkin-Elmer laboratory robotic system for analytical sample preparation.** Hartenstein, S.D.; Delmastro, J.R. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls (USA)). Sep 1988. Contract AC07-84ID12435. 52p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006385/JAW.

The purpose of this study was to evaluate the abilities of a Perkin-Elmer (PE) robotic system in performing complex analytical sample preparation procedures. Until this time, reports have been written describing the physical capabilities of the robotic arm marketed by PE and the use of this arm in a pick-and-place application at the Idaho Chemical Processing Plant (ICPP). Since the robotic arm is only capable of handling and transporting objects, the ability of the PE system is dependent upon the performance capabilities of the auxiliary devices marketed with the arm. 2 refs., 2 figs., 1 tab.

13316 **Precision adjustable stage.** Cutburth, R.W.; Silva, L.L. (to Dept. of Energy, Washington, DC). US Patent 4,772,109. 20 Sep 1988. Filed date 26 Sep 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an adjustable mounting stage comprising: base means having two opposite sides and an end wall, each side including a pair of spaced ball bearing support means mounted proximate opposite ends of the base means without intermediate support means; a rectangular block adapted for sliding movement along the spaced ball-bearing support means; and an adjustment screw journaled at the end wall and threaded into one end of the block for reversibly moving the block along the ball-bearing support means; the adjustment screw including a knob for facilitating rotation, and the stage further comprising ball detent means between the end wall and the knob for preventing undesired rotation of the knob and associated movement of the block.

13317 **Applications of high temperature superconductivity.** Wolsky, A.M.; Daniels, E.J.; Giese, R.F. (Technology Evaluations, Energy and Environmental Systems Div., Argonne National Lab., 9700 So. Cass Ave., Argonne, IL (US));. pp v of Superconductivity and its application. New York, NY; Elsevier Science Pub. Co. Inc. (1988). (CONF-880466—).

From 2. annual conference on superconductivity and its applications; Buffalo, NY, USA (18 Apr 1988).

The future applications of high temperature superconductors are reviewed. Emphasis is given to economic considerations, performance goals, and the research and development that remains to be done. Recent studies suggest that increasing current density to 10/sup 4/-10/sup 5/ amps per cm/sup 2/ in fields of 1-3 Tesla is more important than only raising T/sub c/. The desirability of revising past designs of superconducting equipment to take better economic advantage of the hoped for properties of LN/sub 2/ superconductors will also be stressed. The possibility of building smaller devices (e.g., generators) than were discussed in past years will also be stressed because smaller devices will find a larger market. High temperature superconductors may offer capital savings as well as energy savings. This is crucial because their ultimate use will be determined by profitability.

13318 **Some aspects of high T/sub c/ superconductivity.** Kresin, V.Z. (Materials and Chemical Sciences Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US));. pp v of Low temperature electronics and high temperature superconductors. Volume 88-9. Raider, S.I.; Kirschman, R.; Hayakawa, H.; Ohta, H. Pennington, NJ; The Electrochemical Society (1988). (CONF-871072—).

From Low temperature electronics and high temperature superconductors symposium; Honolulu, HI, USA (19 Oct 1987).

The peculiar properties of the new high T/sub c/ oxides, such as a small value of the coherence length, layered structure, etc., lead to an opportunity to observe gap anistropy as well as multigap structure. The use of proximity systems containing high T/sub c/ films is promising from the point of view of making a three-terminal device.

13319 **Low-noise cryogenically cooled broad-band microwave preamplifiers.** Leskovar, B. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US));. pp v of Low temperature electronics and high temperature superconductors. Volume 88-9. Raider, S.I.; Kirschman, R.; Hayakawa, H.; Ohta, H. Pennington, NJ; The Electrochemical Society (1988). (CONF-871072—).

From Low temperature electronics and high temperature superconductors symposium; Honolulu, HI, USA (19 Oct 1987).

This present noise performance, bandwidth capability and gain stability of low-noise cryogenically cooled broad-bank preamplifiers are summarized and reviewed in the 150 MHz - 4 GHz frequency range. The stability factor of Galium Arsenide Field-Effect transistors as a function of frequency and ambient temperature is presented and discussed. Also other performance data, such as gain nonuniformity, phase shift as a function of frequency, and voltage standing-wave ratio, of several low-noise wide-band preamplifiers of interest for research instrumentation systems are presented.

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REFER ALSO TO CITATION(S) 13156, 13684, 14021

13320 **(AD-A—199622/2/XAB) Kinetics and dynamics of iodine monofluoride formation in gas-phase collisions. Final report, 1 December 1984-31 May 1988.** Whitehead, J.C. (Manchester Coll. of Science and Technology (UK). Dept. of Chemistry). 15 Sep 1988. 9p. NTIS, PC A02/MF A01.

The production of IF(B) in gas-phase collisions of fluorine atoms with various organic and inorganic iodides was investigated to determine methods of efficient production. The key role of electronically excited iodine atoms was identified. Excimer-laser photolysis of mixtures of molecular fluorine and organic iodides is shown to yield high-pulse intensities of IF(B).

13321 **(AD-A—199627/1/XAB) Computer simulations of radiation generation from relativistic electron beams. Final report, 1 October 1985-30 September 1987.** Lin, A.T. (California Univ., Los Angeles (USA). Dept. of Physics). 30 Sep 1987. 91p. NTIS, PC A05/MF A01.

Research into mode competition in the Lowbitron and efficiency enhancement through magnetic field profiling; a novel method of gain and efficiency enhancement in the CARM (Electron Cyclotron Autoresonance Maser) which makes use of a transverse helical wiggler to inhibit parasitic autoresonant acceleration of electrons by the electromagnetic wave; absolute instability and tunability of the CARM through varying the solenoidal field; and cyclotron effective in an FEL (Free Electron Laser) with an axial guide magnetic field was carried out. The technical specification for a CARM oscillator in the megawatt power range, with the aim of designing a cost-effective experiment utilizing an existing Magnetron Injection Gun and a gyrotron magnet, which will serve to verify the basic physics of the CARM and demonstrate its viability was also investigated. Extensive use of computer simulations using relativistic, electromagnetic PIC codes was made in this study.

13322 **(AD-A—199638/8/XAB) Proof of the feasibility of coherent and incoherent schemes for pumping a gamma-ray laser. Quarterly progress report, 1 April-30 June 1988.** Collins, C.B. (Texas Univ., Richardson (USA). Center for Quantum Electronics and Applications). Jul 1988. 115p. (GRL—8801). NTIS, PC A06/MF A01.

Recent approaches to the problem of the gamma-ray laser have focused upon upconversion techniques in which metastable nuclei are pumped with long-wavelength radiation. At the nuclear level the storage of energy can approach tera-Joules per liter for thousands of years. This report focuses upon a variety of new technologies to demonstrate feasibility benefitting from the strong momentum realized already along the approach to incoherent pumping, most continued to advance the development of the nuclear analog of the ruby laser. A unique type of Compton spectrometer was brought into service during this reporting period. The greatest breakthrough was realized along the more complex approach of coherent pumping. There it is intended to mix the quantum properties of long-lived isomeric states with those of freely radiating nuclear levels. Contents: Thermal economy of a gamma-ray laser; Determination of gateway states in Au 197 with a Compton gamma-ray spectrometer; Limits on neutron-activation interferences in photoactivation cross-section measurements in the 1.5-6 MeV range; A flash x-ray source excited by stacked blumlein generators; Preliminary study of a laser ion source for growing diamond-like carbon films; and Large-scale effects of the magnetic-phase modulation of recoilless gamma transitions.

13323 **(AD-A—199775/8/XAB) Reflection matrix for optical resonators in FEL (free electron lasers) oscillators. Interim report.** Riyopoulos, S.; Sprangle, P.; Tang, C.M.; Ting, A. (Naval Research Lab., Washington, DC (USA)). 22 Sep 1988. 49p. (NRL-MR—6285). NTIS, PC A03/MF A01.

The transformations of Gaussian-radiation beams caused by reflection off-mirrors is an important issue for FELs operating as oscillators. The reflected radiation from a single incident Gaussian mode will contain other modes due to the finite mirror size, the de-

flection of the beam and mismatches in the curvature. A method for analytic computation of the reflection matrix is developed by taking the convolution of the source function at the surface of the mirror with the paraxial propagator. The mirror surface that reflects spherical incoming wavefronts into spherical outgoing is found to be a paraboloid. Integral expressions for the reflection coefficients R/sub pq//sup mn/ for any incoming mode u/sub mn/ into the outgoing u/sub pq/ are obtained as function of the reflection angle phi, the reflected beam spot size W/sub 0/, and the mirror size. The coefficient R/sub 00//sup 00/ for the lowest-to-lowest mode reflection is determined analytically. The spot size W/sub 0/ can then be selected, depending on the mirror size, to maximize R/sub 00//sup 00/. The ratio of the mirror size to the spot size is the dominant factor determining the reflection coefficient. The effects of deflecting the light beam enter as small corrections, of first order in the diffraction angle theta/sub d/ $< <1$.

13324 **(AD-A—200060/2/XAB) Annual technical summary and status report on Contract N00014-79-C-0769 (Columbia University, New York, Bew York). Report for October 1987-September 1988.** Marshall, T.C. (Cornell Univ., Ithaca, NY (USA). Dept. of Physics). Sep 1988. 28p. NTIS, PC A03/MF A01.

Observations of Optical Guiding in a Raman Free-Electron Laser; Evidence for optical guiding of 1.7-mm-wavelength radiation along an electron beam in a Raman free-electron laser is obtained experimentally and compared with numerical simulations. Optical guiding is manifest as the interference effect of several waveguide modes; this is observed beyond the point of electron-beam termination. The experiment operates in the regime of exponential signal gain and appreciable electron-beam space charge. Sideband instabilities and optical guiding in a free-electron laser: experiment and theory; Experimental and theoretical studies of the effects of tapering and optical guiding on sideband instabilities are reported. The experiments are performed in the Columbia Raman FEL (about 2mm). Experiment shows sizeable reductions in sideband amplitudes in an efficiency-enhanced undulator. In the presence of optical guiding in a constant-period undular, the sideband shift is larger compared with the case when optical guiding does not occur.

13325 **(AD-A—200155/0/XAB) Single-frequency Ti:Al_2O_3 ring laser.** Schulz, P.A. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Jun 1988. 8p. (JA—6070). NTIS, PC A02/MF A01.

Pub. in IEEE Jnl. of Quantum Electronics, Vol. 24, No. 6, 1039-1044(Jun 1988).

The Ti:Al_2O_3 laser is a widely tunable infrared laser with outstanding performance. The advantages of the Ti:Al_2O_3 laser over the infrared dye laser are greater convenience and more stable operation. Over 500 mW of single-frequency power was obtained from a titanium: aluminum oxide (Ti:Al_2O_3) ring laser pumped by 10 W (all lines) from an argon ion laser. The ring laser can be tuned from 750 to 850 nm while maintaining more than 100 mW in single-frequency operation without realignment or a change of optics. The free-running frequency stability of the laser is 2 MHz. Thermal effects cause changes in the ring-cavity parameters, limiting the output power. This ring laser has also been operated with an acousto-optic mode locker to obtain 200 ps mode-locked pulses at 250 MHz with nearly the same average power as in single-mode operation.

13326 **(AD-A—200292/1/XAB) Intense XUV radiation sources. Final report, 1 April 1985-30 September 1987.** (Maryland Univ., College Park (USA). Inst. for Physical Science and Technology). 30 Sep 1987. 43p. NTIS, PC A03/MF A01.

The results of the Nd:YAG laser (1.064 micrometer) experiments showed that the EUV output increased with laser pulse energy in a linear manner or slower. Therefore, there was no special incentive to go to higher pulse energies in the driver since increased problems of optical damage and of output saturation argued against moving in that direction. Because it was felt that higher repetition rates could translate directly into higher average outputs and published data indicated that the soft x-ray yield might be increased by use of shorter wavelengths in the laser driver, a 150-Hz excimer laser operating at 248 nm was purchased and installed as the driver for the laser plasmas. The peak pulse energy of this laser (Lambda Physik) with normal optics is 400 m/pulse energy of 320 m. Experiments with this system confirmed expectations and a reduction in exposure times for VUV and EUV emulsions of a factor of more than 20 when using rhe excimer rather than the Nd:YAG as a driver was observed. A major disadvantage in the use of a laser plasma light source has been the generation of large amounts of debris from the target, which coats optics and lithograph masks. A series or studies intended to minimize the amounts and effect of target debris, using the excimer laser driver were performed. Experience gained from these studies provided the basis for the new generation laser plasma light source chamber just completed in the laboratory. A paper is being prepared describing the new generation light source in detail.

13327 **(AD-A—200370/5/XAB) Multiline operation of mercury halide lasers.** Kushawaha, M.; Mahmood, M. (Howard Univ., Washington, DC (USA). Dept. of Physics). 1988. 7p. NTIS, PC A02/MF A01.

Pub. in Spectroscopy Letters, Vol. 21, No. 1, 63-68(1988).

Emission spectrum of the (B-X) band system of HgX radicals (X=chlorine, bromine, iodine) was observed by passing electrical discharge through flowing vapors of mercury halides. The emission intensity of the most intense band of the (B-X) system of these radicals was observed to decrease in the presence of other mercury halide vapors at temperatures higher than 130C. Laser action was observed from the (B-X) transition of mercurous chloride, mercurous bromide, and mercurous iodide radicals by electrical discharge pumping of mercuric chloride, mercuric bromide and mercuric iodide vapors individually.

13328 **(BNL—41995) Description of FEL3D: A three dimensional simulation code for TOK and FEL.** Dutt, S.; Friedman, A.; Gover, A. (Brookhaven National Lab., Upton, NY (USA)). 20 Oct 1988. Contract AC02-76CH00016. 30p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005529/JAW.

FEL3D is a three dimensional simulation code, written for the purpose of calculating the parameters of coherent radiation emitted by electrons in an undulator. The program was written predominantly for simulating the coherent super-radiant harmonic frequency emission of electrons which are being bunched by an external laser beam while propagating in an undulator magnet. This super-radiant emission is to be studied in the TOK (transverse optical klystron) experiment, which is under construction in the NSLS department at Brookhaven National Laboratory. The program can also calculate the stimulated emission radiometric properties of a free electron laser (FEL) taking into account three dimensional effects. While this application is presently limited to the small gain operation regime of FEL's, extension to the high gain regime is expected to be relatively easy. The code is based on a semi-analytical concept. Instead of a full numerical solution of the Maxwell-Lorentz equations, the trajectories of the electron in the wiggler field are calculated analytically, and the radiation fields are expanded in terms of free space eigen-modes. This approach permits efficient computation, with a computation time of about 0.1 sec/electron on the BNL IBM 3090. The code reflects the important three dimensional features of the electron beam, the modulating laser beam, and the emitted radiation field. The statistical approach is based on averaging over the electron initial conditions according to a given distribution function in phase space, rather than via Monte-Carlo simulation. The present version of the program is written for uniform periodic wiggler field, but extension to nonuniform fields is straightforward. 4 figs., 5 tabs.

13329 **(DOE/DP/20144—T1) The laser in America: [Final technical report].** Bromberg, J.L. (Laser Inst. of America, Toledo, OH). [1988]. Contract FG01-85DP20144. 483p. NTIS, PC A21. Order Number DE89000029/JAW.

This book reviews the discovery and development of lasers in America. The chapters are: The Maser; The Birth of the Laser; Laser Research Takes Off; Out of the Laboratory and into the Marketplace; Explaining Laser Development; and The Military Response to the Laser. (LSP)

13330 **(LA-UR—88-3325) Rf photoelectron gun experimental performance.** Sheffield, R.L.; Cornelius, W.D.; Nguyen, D.C.; Springer, R.W.; Lamartine, B.C.; Gray, E.R.; Watson, J.M.; Fraser, J.S. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 3p. (CONF-881049—59). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005442/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Free-electron lasers require electrons beams of high peak brightness. In this paper, we describe the performance of a compact high-brightness electron source for driving short-wavelength free-electron lasers. The experiment uses a laser-illuminated photoemitter located in the first rf cavity of a two-cavity linac. The photocathode source and associated hardware are described. The doubled ND:YAG laser (532 nm), which is used to drive the photocathode, produces 75-ps micropulses at a 108-MHz repetition rate and peak powers of approximately 300 kW. Diagnostics include a pepper-pot emittance analyzer, a magnetic spectrometer, and a <4-ps resolution streak camera. Present experiments give the following results: micropulse current amplitudes of 10 mA to 400 A, 75% beam emittances ranging from 10 π {center←dot} mm {center←dot} mrad to 40 π {center←dot} mm {center←dot} mrad and peak current densities of >600 A/cm^2. Results on photocathode lifetime will be presented. Future plans for applications of the photoinjector at Los Alamos National Laboratory are discussed. 7 refs., 4 figs., 2 tabs.

13331 **(LA-UR—88-4030) Liquid excimers: Lasing Xe_2 and Kr_2 in liquid argon.** Loree, T.R.; Showalter, R.R.; Birmingham, B.S.; Johnson, T.M.; Hughes, W.M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-881244—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005449/JAW.

From LASERS '88; Lake Tahoe, NV, USA (5 Dec 1988).

By pumping a small cryogenic cell with a 40-ns, 1 MeV e-beam pulse, we have excited lasing in dilute mixtures of xenon or krypton in argon. The lasing occurred at 175 nm for the excimer Xe_2 and 147 nm for Kr_2. 14 refs., 4 figs.

13332 **(LA-UR—88-4149) Free electron lasers using stable-unstable ring resonators.** Schmitt, M.J.; Paxton, A.H. (Los Alamos National Lab., NM (USA)). 1989. Contract W-7405-ENG-36. 8p. (CONF-890145—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005462/JAW.

From SPIE conference on optics, electro-optics and laser applications in science and engineering: OE/LASE '89; Los Angeles, CA, USA (15 Jan 1989).

The free electron laser (FEL) simulation code FELEX is used to examine the operation of stable-unstable FEL resonators. These resonators are stable along one transverse axis and unstable along the orthogonal transverse axis. The simulations utilize a ring resonator with an intracavity focus in the unstable plane near the center of the wiggler (close to the same axial position as the waist in the stable plane) thereby enhancing the coupling between the optical and electron beams. Asymmetric output scraping is performed in the back leg of the ring using a reflective mirror inserted from one side of the unstable axis. Resonators with relatively low equivalent Fresnel number ({vert←bar}N/sub eq/{vert←bar} $\leqq$ 10) and magnification ({vert←bar}M/sub x/{vert←bar} $\cong$ 1.2) are examined. Optical characteristics including the cavity mode profile at various positions inside the resonator are shown. 8 refs., 8 figs.

13333 **(LA-UR—88-4163) XUV free-electron laser development at Los Alamos.** Newnam, B.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-881049—54). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005463/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Free-electron lasers (FELs) for the vacuum-ultraviolet and soft x-ray spectral regions (together termed the XUV) are being designed at Los Alamos for integration into a future national UV/XUV FEL user facility for scientific experimentation. As proposed, this facility would consist of a sequence of up to 15 FEL oscillators and amplifiers, driven by a single, rf-linear accelerator, that will generate broadly tunable, picosecond-pulse, coherent radiation over the range from 1 to 400 nm. Below 300 nm, the peak- and average-power output of these FEL devices should surpass the capabilities of any existing, continuously tunable photon sources by many orders-of-magnitude. We describe the design parameters and predicted output of these FELs and make comparison with synchrotron radiation sources. Brief mention is given to our recent progress in developing the three primary components (electron beam, magnetic undulator, and resonator mirrors). 30 refs., 2 figs., 3 tabs.

13334 **(N—89-12053) Development of mid-infrared solid state lasers for spaceborne lidar. Semiannual progesss report, 13 April-13 October 1988.** Whitney, D.A.; Kim, K.H. (Hampton Inst., VA (USA)). 1988. 36p. (NASA-CR—183341; NAS—1.26:183341). NTIS, PC A03/MF A01.

This semiannual progress report covers work performed during the period from April 13, 1988 to October 13, 1988 under NASA grant number NAG-1-877 entitled, Development of mid-infrared solid state lasers for spaceborne lidar. We have designed a flashlamp-pumped Cr3(+);GSAG laser of pulsed laser energy greater than 200 mJ and of pulse width of 1 ms FWHM to simulate a high-power laser diode in pumping mid-infrared laser crystals such as Tm3(+), Er3(+), and/or Ho3(+)-ion doped YAG, YLF or other host materials. This Cr3(+);GSAG laser will be used to determine optimum conditions for laser diode pumped mid-infrared lasers, maximum energy extraction limit with longitudinal pumping, thermal damage limit, and other problems related to high power laser diode pumping. We have completed a modification of an existing flashlamp-pumped and liquid nitrogen cooled rare earth laser system for 60 J electrical input energy and a 500 micron pulse width, and have carried out preliminary experiments with a Ho(+):Er3(+):Tm3(+):YAG crystal to test the system performance. This flashlamp-pumped rare earth laser system will be used to determine optimum Tm3(+)-ion concentration in Ho3(+):Cr3(+):Tm3(+):YAG crystal in the remaining research period.

13335 **(PB—89-131908/XAB) Reporting guide for laser-light shows and displays (21 CFR 1002).** (Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health). May 1988. 21p. (FDA/CDRH—89/12). NTIS, PC A03/MF A01.

See also PB—86-192689.

The guide is to be used for reporting laser-light shows or displays incorporating Class IIIb or Class IV lasers only. Separate reports are not required for shows or displays that incorporate Class I, IIa, II, or IIIa laser-projection systems. Such show descriptions must be included in the user instructions and the report for the laser projector. Laser projectors used in any light shows or displays regardless of the class of the projector must be certified by the manufacturer and reported using the guide titled, Guide for Preparing Initial Reports and Model Change Reports on Lasers and Products Containing Lasers, HHS Publication FDA 86-8259. These guides assist manufacturers in providing the information that the Center for Devices and Radiological Health (CDRH) needs to determine how laser-light-shown projections and laser-light shows comply with the Federal standard for laser products (21 CDR 1040.10 and 1040.11) and with the conditions of an approved variance.

13336 **(PB—89-853717/XAB) Iodine lasers. January 1975-January 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-January 1989.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 150p. NTIS PC N01/MF N01.

This bibliography contains citations concerning the design, development, and analysis of continuous-wave and pulsed iodine lasers for industrial and research applications. Included are design and analysis of components, such as laser oscillators, amplifiers, and techniques for passive-mode locking and optical energy storage. (Contains 270 citations fully indexed and including a title list.)

13337 **(UCRL—97892) Sideband generation in saturated pulsed dye amplifiers with multiple cw single mode injection.** Comaskey, B.; Daly, T.; Haynam, C.; Morris, J.; Paisner, J.; Young, R. (Lawrence Livermore National Lab., CA (USA)). Jan 1988. Contract W-7405-ENG-48. 19p. (CONF-880110—35). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005654/JAW.

From SPIE O-E Lase '88: optoelectronics and laser applications in science and engineering; Los Angeles, CA, USA (10 Jan 1988).

The output spectral characteristics of fully saturated pulsed dye amplifiers for multimode input waves having amplitude modulation (AM) are modeled and compared with experimental measurements. The AM input in our experiments was generated by combining the outputs of two single-mode dye lasers. The spectral output of the saturated dye amplifiers consisted of the input frequencies and several sidebands spaced by the input difference or beat frequency. For our experimental system with kiton red dye amplifiers, up to 20% of the output intensity was contained in these sidebands. Sideband production was observed to decrease as the beat frequency increased with a characteristic half-width of approximately 10 GHz. 6 refs., 12 figs., 1 tab.

13338 **Free electron laser injection oscillator.** Gover, A.; Gold, S.H.; Granatstein, V.L. (to Secretary of the Navy, Washington, DC). US Patent 4,779,277. 18 Oct 1988. Filed date 9 Mar 1983. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a free electron laser comprising: a resonant optical cavity; wiggler magnet means for producing a spatially periodic magnet field in the cavity; means for injecting a beam of relativistic electrons into the cavity; means for injecting a polarized input optical beam into the cavity, the input optical beam and the electron beam interacting under the influence of the magnetic field to amplify the input optical beam, the input optical beam having a wavelength lying within the gain bandwidth of the free electron laser interaction, wherein the input optical beam injecting means includes source means for producing the polarized optical beam; and optical switch means located within the cavity for controlling the transmission of the polarized optical beam into and out of the cavity, the transmitted polarized optical beam forming the input optical beam; wherein the input optical beam is polarized along a first polarization plane; and the magnetic field vectors of the spatially periodic magnetic field are oriented perpendicular to the first polarization plane.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 12519, 12958, 13305, 13455

13339 **(AD-A—200247/5/XAB) Spray formation: three-dimensional liquid break-up due to surface tension. Final report, April 1986-March 1988.** Childs, R.E. (Nielsen Engineering and Research, Inc., Mountain View, CA (USA)). 9 Aug 1988. 17p. (NEAR-TR—389). NTIS, PC A03/MF A01.

The growth instabilities on the interface between a liquid jet and its gaseous environment is an important mechanism in spray atomization, and it is the subject of the work reported herein. Numerical simulations based on the Navier-Stokes equations were used to model liquid/gas interface flows. An algorithm was developed for solving the unsteady Navier-Stokes equations for incompressible fluid with a discontinuity in density and with surface tensions and its accuracy was demonstrated. In flows representative of round pressure-atomized jets and pressure-swirl atomizers, nonuniform mean velocity distributions resulting from viscous boundary-layers were found to have a significant effect on instability growth. In a round jet, the inclusion of a boundary-layer-like velocity profile significantly reduced the growth rate of small-wavelength instabilities. The velocity profile had a much greater effect than surface tension on the initial atomization process for the flow parameters considered. A good estimate of initial fuel droplet size was obtained by considering boundary-layer effects but disregarding surface tension. In a flow representative of the fuel issuing from a pressure-swirl nozzle, nonuniformity of the velocity profile was found to increase the growth rate of a disturbance mode which is directly responsible for spray breakup.

13340 **(ENEA-RT-VEL—88-2) Cavitation, subcooled boiling and a measuring method developed at ENEA.** Tirelli, D. (ENEA, Bologna (Italy). Centro di Calcolo). (ENEA, Rome (Italy)). 1988. 20p. (In Italian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705250/JAW.

A brief description of cavitation and subcooled boiling is reported; their effects, measuring methods, operating limits and prescribed standards are described. The whole, to better clarify the usefulness and the importance of a measuring instrument developed at ENEA, to study the above phenomena.

13341 **(FRCEA-TH—129) Two-dimensional critical phenomena.** Saleur, H. (Paris-6 Univ., 75 (France); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). Sep 1987. 331p. (In French). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88756672/JAW.

Two dimensional critical systems are studied using transformation to free fields and conformal invariance methods. The relations between the two approaches are also studied. The analytical results obtained generally depend on universality hypotheses or on renormalization group trajectories which are not established rigorously, so numerical verifications, mainly using the transfer matrix approach, are presented. The exact determination of critical exponents; the partition functions of critical models on toruses; and results as the critical point is approached are discussed.

13342 **(JAERI-M—88-174) Analysis of inverted annular film boiling by the MINCS code using two-fluid model.** Wang, Kaiming; Watanabe, Tadashi; Hirano, Masashi. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Sep 1988. 50p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756573/JAW.

A set of new constitutive relations appropriate to Inverted Annular Film Boiling regime has been developed based on Aritomi's experiment using Freon-113. Conservation equations for two-fluid model together with proposed constitutive relations were solved numerically by the two-phase flow analyzer MINCS which had been developed at Japan Atomic Energy Research Institute. Calculated results for the Aritomi's test were in good agreement with the experimental results. The proposed model were applied to the analysis of Stewart's experiment using water for verification. A better agreement between calculated and experimental results was also obtained at relatively low pressure condition. The effects of liquid inlet subcooling, pressure and flow rate on wall heat transfer coefficient were discussed.

13343 **(N—89-12027) Asymptotic induced numerical method for the convection-diffusion-reaction equation. Final report.** Scroggs, J.S.; Sorensen, D.C. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Oct 1988. 34p. (NASA-CR—181730; ICASE—88-60; NAS—1.26:181730). NTIS, PC A03/MF A01.

A parallel algorithm for the efficient solution of a time dependent reaction convection diffusion equation with small parameter on the diffusion term is presented. The method is based on a domain decomposition that is dictated by singular perturbation analysis. The analysis is used to determine regions where certain reduced equations may be solved in place of the full equation. Parallelism is evident at two levels. Domain decomposition provides parallelism at the highest level, and within each domain there is ample opportunity to exploit parallelism. Run time results demonstrate the viability of the method.

13344 **(PSI—6) General numerical procedure for the treatment of moving interfaces in implicit continuous Eulerian (ICE) hydrodynamics.** Smith, B.L. (2314000CH). (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). Oct 1988. 41p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705217/JAW.

The implicit continuous Eulerian (ICE) finite difference method in hydrodynamic computations has proven very successful when applied to flow situations in which there are excessive fluid distortions. Code logic becomes exceedingly complex, however, if the boundaries of the fluid domain are material interfaces whose orientations with respect to the Eulerian grid evolve during the calculation. It is shown in this article that within the ICE methodology it is possible to express the discrete mass conservation condition in an identical form for all computational cells, even those containing, or close to, moving fluid boundaries. From this basis a generalized ICE algorithm is built up alleviating many of the difficulties associated with complicated configurations of free and structure boundaries. In particular, an effective treatment of slug impact with fluid-structure interaction is readily formulated. To illustrate the technique in practical situations, the method has been incorporated into a version of the coupled fluid-structure code SEURBNUK-EURDYN, used for LMFBR safety analysis, and a number of fluid-gas, fluid-structure situations are analyzed. Results are compared with analytic solutions, experimental measurement, and/or other code predictions, as appropriate. Two oblique, slug impact situations are included. (author) 37 refs., 24 figs.

4205 Materials Testing

REFER ALSO TO CITATION(S) 12877, 12994, 13094, 13302, 13454

13345 **(CONF-8808157—1) Neutron radiography techniques and applications.** McCellan, G.C. (Argonne National Lab., Idaho Falls, ID (USA)). 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005879/JAW.

From Non-destructive testing and evaluation for manufacturing and construction; Urbana, IL, USA (9 Aug 1988).

Neutron radiography is not used as extensively as other methods of industrial radiography, but the range of applications is constantly expanding. In some applications, such as critical aerospace components having appropriate neutron attenuation properties, neutron radiography has become an indispensable part of the quality assurance process. The use of neutron radiography has been limited to some degree by the cost and complexity of the facilities required. This has prevented the on-site inspection required in many potential applications. However, the small portable accelerator and isotopic neutron radiography sources and efficient real-time detection systems now being developed will hopefully permit more widespread use of this important technique. This paper covers both historical and applications aspects of neutron radiography. 8 refs.

13346 **(EGG-M—88442) Acoustic-optic measurement of micromechanical resonance for adhesive bond integrity.** Barna, B.A.; Allemeier, R.T.; Rodriguez, J.G.; Tow, D.M. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 6p. (CONF-880760—8). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005416/JAW.

From Review of progress in quantitative nondestructive evaluation; La Jolla, CA, USA (31 Jul 1988).

Traditional nondestructive evaluation (NDE) of bonding flaws has generally used either ultrasound or x-rays as a directed energy source to image or otherwise detect the discontinuity of an improper bond. While this approach has broad applicability, it is inadequate where the material is highly attenuating or anisotropic, or when it is impossible to achieve an adequate interrogation due to geometrical constraints. These difficulties are seen in materials such as the silica fiber composites used for the thermal protection tiles on the Space Shuttle Orbiter, insulating rubber liners used for solid rocket motors, and rubber or foam coating materials. This paper discusses a method for determining bond condition in these types of materials by exciting the component as a whole and analyzing its micromechanical response. The concept is that the bond region forms a boundary of a physical system whose dynamic response is governed by a deterministic set of equations of motion. As the boundary conditions change, the system response will change. The problem then reduces to verifying that a given dynamic response can be uniquely correlated with a specific bond condition. This approach has a distinct advantage in that it can potentially survey the bond condition of a component or region with a single rapid measurement and provide the basis for a "go/no-go" decision. 2 refs., 5 figs.

13347 **(IS-M—614) Ultrasonic techniques for the quantitative characterization of texture: A survey.** Lee, S.S.; Smith, J.F.; Thompson, R.B. (Ames Lab., IA (USA)). 1986. Contract W-7405-ENG-82. 14p. (CONF-861076—10). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005010/JAW.

From Fall meeting of the Metallurgical Society of AIME; Orlando, FL, USA (5 Oct 1986).

Advances in the quantitative ultrasonic measurement of texture are surveyed. These advances are based on two recent developments. An increased activity within the mechanics community has led to an improved understanding of the relationship between the velocities of ultrasonic modes of rolled plates and the coefficients of the expansion of the crystallites orientation distribution function (CODF) in terms of generalized Legendre functions. Instrumentation advances have made it possible to perform the ultrasonic measurements simply under field conditions. For cubic crystallites, it is shown that the coefficients W_{420} and W_{440} can be determined from the angular variations of the velocities of selected modes in the plane of the plate. An absolute measurement is required to determine W_{400}. The use of the W/sub 4mn/ to compute ultrasonic pole figures is also discussed. Application of the theory is illustrated by experimental results on aluminum and copper. 31 refs., 4 figs., 1 tab.

13348 **(JAERI-M—88-172) Recommended practice for small punch (SP) testing of metallic materials (draft).** Takahashi, Hideaki; Shoji, Tetsuo; Mao, Xinyuan and others. (Tohoku Univ., Sendai (Japan)). (Japan Atomic Energy Research Inst., Tokyo). Sep 1988. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756572/JAW.

This practice covers the determination of fracture toughness characteristics of metallic materials such as ductile to brittle transition temperature (SPDBTT) and elastic-plastic fracture toughness (J/sub ICSP/) using miniature small punch (SP) specimens. Three kinds of specimens with different shape; 10 by 10 by 0.5 mm, 10 by 10 by 0.25 mm and phi3 by 0.25 mm, are selected as the standard SP specimens. Two types of fixture shall be respectively used for the 10 and phi3 specimens. The relationship between load and deflection during buldge tests shall be recorded from low to high temperatures. Following two parameters in relation to fracture toughness are obtained from analyses of load-deflection curves: (1) The SP energy is calculated from the area surrounded with load-deflection curves, which corresponds to the total energy consumed up to the fracture. (2) The equivalent fracture strain (ϵ-bar/sub qf/) is calculated from the maximum deflection at fracture (δ*). The SPDBTT can be derived from temperature dependence of SP energy, and the J/sub ICSP/ can be estimated from the rational correlation curve between ϵ-bar/sub qf/ and J/sub IC/.

13349 **(PB—89-852305/XAB) Nondestructive testing: neutron radiography and neutron activation. January 1975-December 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 98p. NTIS PC N01/MF N01.

Supersedes PB—85-859973.

This bibliography contains citations concerning neutron radiographic principles, techniques, and nondestructive testing or evaluation of numerous types of materials, objects, and structures for the detection of flaws or defects. Considerable attention is given to spent nuclear fuel assemblies and waste solids. (This updated bibliography contains 177 citations, 29 of which are new entries to the previous edition.)

13350 (PB—89-852560/XAB) Graphite lubricants. June 1970-December 1988 (Citations from the Compendex data base). Report for June 1970-December 1988. (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 67p. NTIS PC N01/MF N01.

Supersedes PB—86-869401.

This bibliography contains citations concerning graphite particles used as a dry lubricant and as an additive for conventional lubricants. Effects on friction, wear performance, load bearing, contact area, and contact stress are among the topics discussed. Wear modeling, aging, particle structure, purity and particle size relative to synthetic and natural graphites are included. Other dry lubricants such as molybdenum disulfide and mica are considered. (This updated bibliography contains 120 citations, 15 of which are new entries to the previous edition.)

13351 (PB—89-852941/XAB) Synthetic lubricants. February 1983-December 1988 (Citations from the NTIS data base). Report for February 1983-December 1988. (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 67p. NTIS PC N01/MF N01.

Supersedes PB—88-851399.

This bibliography contains citations concerning properties, manufacture, and testing of synthetic lubricants. Physical properties, high-temperature synthetic oils, synthetic crudes, antioxidants, reclamation, chromatographic identification methods, carcinogenicity testing and performance evaluations are discussed. Military and civilian applications are included. (This updated bibliography contains 97 citations, 15 of which are new entries to the previous edition.)

13352 (SAND—88-1708C) Understanding the effects of damping systems on resonant plates. Bell, R.G. (Sandia National Labs., Albuquerque, NM (USA)). [1988]. Contract AC04-76DP00789. 15p. (CONF-890152—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002036/JAW.

From 7. international modal analysis conference (IMAC); Las Vegas, NV, USA (30 Jan 1989).

An accepted technique for simulating pyrotechnic shock has been the resonant plate test. A plate fixture is designed so that the structural modes match the predominant frequency content of a given specification, which is usually a shock response spectrum. The plates are usually mechanically damped by the addition of different masses such as bars, blocks, and even C-clamps. The addition of such masses will naturally influence the mode shapes and the natural frequencies of the plate. The changes in the plates' characteristic frequencies may be so dramatic that the resulting test inputs are unacceptable. Likewise, the added mass may not properly damp the system and may instead act to amplify the residual response of the plate. If the modal characteristic of the plate, component, and the damping masses are known, the added mass can be properly placed on the plate such that the desired response will be achieved. Various combination of damping systems will be analyzed using analytical models and experimental testing. The experimental results will be compared to the analytical model to gain a better understanding and predictive capability of the response of the plate. Mass will then be added to the node lines of the plate to provide the needed damping without causing dramatic changes in the frequency content of the plate. 3 refs., 11 figs., 2 tabs.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 13163, 13182, 13323, 13335, 13448, 13449, 13905, 14080, 14108, 14109

13353 (AD-A—199664/4/XAB) JSEP (Joint Services Electronics Program) annual report. Report for 1 May 1987-30 April 1988. Harris, J.S. (Stanford Univ., CA (USA). Solid-State Electronics Labs.). 30 Jun 1988. 63p. NTIS, PC A04/MF A01.

Contents include: molecular beam epitaxy of high Tc superconductors, ultra-submicron devices, GaAs/Si integrated circuits, the chemical and electronic structure of refractory metal-GaAs interfaces, the study of crystal properties using channeling radiation, complementary MOS device and material physics at 77 K, coding for spectrally constrained channels, and real-time statistical signal processing.

13354 (AD-A—199819/4/XAB) Deposition of InP on Si substrates for monolithic integration of advanced electronics. Final report, 28 September 1987-27 March 1988. Vernon, S.M. (Spire Corp., Bedford, MA (USA)). May 1988. 31p. NTIS, PC A03/MF A01.

The goal of the Phase I effort was to establish a basic growth process for depositing single-crystal InP films on Si substrates: the authors experience in growing high-quality GaAs-on-Si and GaP-on-Si Structures was to provide a background to guide the experiments. Depositions were carried out by atmospheric-pressure MOCVD in a SPI-MO CVD 450 reactor; the sources chemicals used were trimethylindium (TMin) and phosphine (PH3) and the main carrier gas was H_2. Starting from these basic guidelines, a similar process for InP-on-Si was attempted, with the major variables occurring in Step 2, the nucleation procedure, which is really the most-critical step since the surface-oxide-removal procedure (Step 1) had been previously optimized for other heteroepitaxy-on-Si projects. Several different types of nucleation layers/procedures were attempted. These included different materials (InP, In, or P), different thickness, and different temperatures: a brief summary of these runs is listed.

13355 (AD-A—200512/2/XAB) Optical waveguides in oxygen-implanted buried-oxide silicon-on-insulator structures. Kurdi, B.N.; Hall, D.G. (Rochester Univ., NY (USA). Inst. of Optics). Feb 1988. 4p. NTIS, PC A02/MF A01.

Pub. in Optics Letters, Vol. 13, No. 2, 175-177(Feb 1988).

There is continued interest in the use of silicon as a basic material for integrated optics. Compatibility with the technology used for the fabrication of silicon integrated circuits is clearly an important motivation. Several silicon-based integrated-optical systems-waveguide demultiplexers, spectrum analyzers, and others - have already been described in the literature. Newer applications such as the interconnection of electronic circuits and systems, many of which are fabricated in silicon, make the question of the potential role of silicon in integrated optics all the more interesting. The optical waveguide is perhaps the most fundamental component needed for any integrated-optical system. The waveguiding properties of the oxygen-implanted, buried-oxide, silicon-on-insulator structures currently being developed for use in microelectronics are analyzed. It was found that, in spite of the fact that the buried-oxide layer is only a few tenths of a micrometer thick, the single-crystal overlayer can support Te/sub O/ guided-wave propagation, at subbandgap wavelengths, with losses due to substrate radiation leakage at or below the benchmark level of 1 dB/cm.

13356 (KCP—613-4005) Automated convection soldering. Harte, C.G. (Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.). Jan 1989. Contract AC04-76DP00613. 119p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005982/JAW.

The object of this work was to determine the feasibility of convection soldering and process control through automation of the solder process. Convection heating proved feasible for male connectors with no detrimental effects to the connector insulation. Full automation of the soldering process using programmable x-y-z tables and a solder paste dispensing system was achieved for flat flex cables. There were a number of advantages gained by using an automated soldering process. The soldering used for reflowing a joint was eliminated, eliminating possible cold solder joint formation. The size of the flux inclusions in the bottom of the solder cup caused by a temperature gradient on the cup when heat was applied was reduced. There was better control of the soldering time and temperature and the quantity of flux and solder added to each joint. The study became a starting point for the incorporation of new technologies and processes. 1 ref., 27 figs., 2 tabs.

13357 (SAND—88-2574C) Evaluation of CFC substitutes for electronic assembly cleaning. Oborny, M.C. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-8810159—5). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005600/JAW.

From 3. inter-agency cleaning and contamination control seminar; Kansas City, MO, USA (18 Oct 1988).

Based upon concerns that emissions of chlorofluorocarbons (CFCs) are causing the depletion of stratospheric ozone, the Environmental Protection Agency (EPA) has ordered a 50% reduction in the production and usage of CFCs by mid-1998. Since CFCs are widely used for solvent cleaning in electronics manufacturing, electronic manufacturers (including DOE facilities) face the necessity of finding alternative solvents and processes for those applications in which CFCs are currently being employed. In response to this challenge, the Institute for Interconnecting and Packaging Electronic Circuits (IPC) has established a Surface Mount Technology Assembly Cleaning Task Group. This task group is developing a standardized cleaning media test program to evaluate alternative solvents and processes for the cleaning of surface mount assemblies. The ultimate goal of this effort is to identify those alternatives which can be used to replace CFCs in electronic assembly cleaning. 2 refs., 2 figs.

4209 Waste Processing Plants And Equipment

13358 (CONF-8806176—4) Combustion products kinetics model. Ahmed, S.; Kumar, R.; Helt, J.E. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005850/JAW.

From Thermochemical conversion program review meeting; Golden, CO, USA (21 Jun 1988).

There is a need to better understand the combustion process, and the processes leading to the formation and emission of toxic or hazardous products, to improve the efficiency and the operation of energy from municipal waste (EMW) facilities. Design and operation of EMW facilities could be improved if an analytical computer model could predict the formation of combustion products under different sets of operating conditions. Preliminary work is being undertaken to determine if adequate data are available to develop a model that would describe the combustion process and the formation of products not only during combustion, but also during cooling of the combustion products in the heat recovery and gas cleanup systems. As an initial step, development of the model at the solid/gas interface at the incinerator grate is underway. Also, collection of available data on the reaction mechanisms and the kinetics of combustion has been initiated. 4 refs., 3 figs., 1 tab.

13359 (CONF-8806176—5) Experiments on basic mechanisms of pyrolysis. Helt, J.E.; Mallya, N. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 22p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005849/JAW.

From Thermochemical conversion program review meeting; Golden, CO, USA (21 Jun 1988).

A majority of the combustible portion of municipal solid waste (MSW) is cellulosic in nature, comprising paper, newsprint, packaging materials, wood wastes, and yard clippings. If this material is pyrolyzed, the end products are: a highly carbonaceous solid char, a highly oxygenated liquid tar, and a mixture of gases with low to medium Btu content. All of the pyrolysis products offer the potential of being useful fuels or the intermediates for producing useful fuels. Current research at Argonne National Laboratory (ANL) is focused on obtaining a better understanding of the basic mechanisms, kinetics, and chemistry involved in the pyrolytic conversion of MSW and its components. Newsprint, kraft paper, polyethylene, and densified refuse-derived fuel (RDF) have been used individually and in mixtures as feedstock in a batch laboratory reactor. The pyrolysis has been at atmospheric pressure and temperatures of 350{degree}--800{degree}C. The products from the pyrolysis reaction have been analyzed for both fuel properties (e.g., viscosity, calorific value, acid group concentrations) and chemical composition. The liquid products have been studied extensively using Fourier transform infrared spectrometry. Discussion is provided on the overall chemical mechanisms associated with the pyrolytic decomposition. 12 refs., 7 figs., 6 tabs.

13360 (DPST—87-803) Determination of DWPF process stream yield stress and consistency using capillary viscometer technique. Trinh, T.T. (Savannah River Lab., Aiken, SC (USA)). 7 Nov 1988. Contract AC09-76SR00001. 20p. NTIS, PC A03 - OSTI. Order Number DE89004844/JAW.

The attached report outlines a method for the DWPF to determine rheological properties of process slurries on-line using existing instruments in the Liquid Sample Stations. The method was found to be applicable during testing using a prototypic liquid sampling system (TNX). Based on the worst condition of DWPF process slurries (250 dynes/cm^2 and 60 centipoise), the maximum error of the method of calculation is less than 2.4%. Rheology results obtained by this method are comparable to corresponding analytical results via Haake rotational viscometer. 6 refs., 3 figs., 2 tabs.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 12557, 12818, 13058, 13492

13361 (DOE/ER/80210—1) Multi-fuel combustor for gas turbine engines: Phase 1, Final report. Melconian, J.O.; Marden, W.W., III. (SOL-3 Resources, Inc., Reading, MA (USA)). 22 Jan 1987. Contract AC02-84ER80210. 31p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE88017289/JAW.

An innovative can combustor configuration has been developed for gas turbine engines which has the potential of burning fuels ranging from gasoline to coal/water slurries at high efficiencies. The design is based on a Variable Residence Time (VRT) concept which allows large and agglomerated fuel particles adequate time to completely burn. High durability of the combustor is achieved by dual function use of the incoming air. For applications which require the burning of coal/water slurries, the design has the capability of removing the ash particles directly from the primary zone of the combustor. It is anticipated that because of the small size requirement of this combustor design, existing gas turbine engines could be retrofitted within the confines of the current engine envelope. In Phase 1, the feasibility of the concept was successfully demonstrated by three-dimensional mathematical modeling and water analogue tests. The Plexiglas model used in the water analogue tests was designed to fit the current production engine of a major manufacturer. 19 figs., 2 tabs.

13362 (N—89-12932) Considerations in development and implementation of elasto-viscoplastic constitutive model for high temperature applications. Riff, R. (Georgia Inst. of Tech., Atlanta (USA)). 1988. 2p. (NASA-CR—183403; NAS—1.26:183403). NTIS, PC A02/MF A01.

The prediction of inelastic behavior of metallic materials at elevated temperatures has increased in importance in recent years. The operating conditions within the hot section of a rocket motor or a modern gas turbine engine present an extremely harsh thermomechanical environment. Large thermal transients are induced each time the engine is started or shut down. Additional thermal transients from an elevated ambient occur whenever the engine power level is adjusted to meet flight requirements. The structural elements employed in such hot sections, as well as any engine components located therein, must be capable of withstanding such extreme conditions. Failure of a component would, due to the critical nature of the hot section, lead to an immediate and catastrophic loss in power. Consequently, assuring satisfactory long term performance for such components is a major concern. Nonisothermal loading of structures often causes excursion of stress well into the inelastic range. Moreover, the influence of geometry changes on the response is also significant in most cases. Therefore, both material and geometric nonlinear effects are considered.

13363 **(PB—89-853162/XAB) Fluidized-bed combustion. January 1984-December 1988 (Citations from the NTIS data base). Report for January 1984-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 172p. NTIS PC N01/MF N01.

Supersedes PB—87-854345.

This bibliography contains citations concerning research and development activities pertaining to fluidized-bed combustors and combustion processes. Descriptions and evaluations of specific plants and test facilities, subsystems development, and the testing of a variety of fuels and sorbent materials are among the topics considered. (This updated bibliography contains 236 citations, 32 of which are new entries to the previous edition.)

13364 **(PB—89-853246/XAB) Pulse combustion: commercial, industrial, and residential applications. January 1970-December 1988 (Citations from the NTIS data base). Report for January 1970-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 117p. NTIS PC N01/MF N01.

Supersedes PB—87-855391.

This bibliography contains citations concerning the evolution of pulse combustion, the types of pulse combustion burners and their applications, and selected fuels used. Topics include fuel-combustion efficiency, energy conversion and utilization technologies, modeling of chemical kinetics, and dynamics and thermal characteristics of pulse combustors. Pulse-combustion systems for water heaters, gas furnaces, industial and residential boilers, commercial-cooking equipment, and space-heating devices are presented. (This updated bibliography contains 189 citations, 81 of which are new entries to the previous edition.)

13365 **(SAND—88-8010) International Energy Agency conservation in combustion, 1977--1987: Ten years of collaborative research.** (Sandia National Labs., Livermore, CA (USA)). 1988. Contract AC04-76DR00789. 48p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006404/JAW.

This brochure presents an overview of activities conducted under the Implementing Agreement for Energy Conservation in Combustion, which was organized under the auspices of the International Energy Agency (IEA). The agreement calls for studying the combustion of primary fossil fuels, which provide more than 90% of the energy needed in industrial countries. Responding to market and regulatory conditions, manufacturers have developed price-competitive engines, furnaces, and boilers that are clean and reliable. As a result, the thermal efficiencies of existing combustion units are not optimum. For example, the efficiencies of internal combustion engines could probably be improved by around 20%. Recent computer advances have made it possible to develop complex numerical models of combustion, and recent advances in lasers have allowed for new measurements of the combustion process. If combustion can be simulated numerically and measured precisely, then we can ultimately increase the technical and economic performance of our engines, furnaces, and boilers, while maintaining optimal efficiency. Under the agreement, eight countries participate: Canada, Germany, Italy, Japan, Norway,Sweden, the United Kingdom, and the United States. For the program, the United States is the Operating Agent. The purpose of the program is to provide the improved understanding necessary to develop new combustion equipment that not only runs more efficiently, but also causes less pollution and is capable of using alternative fuels. 37 figs., 4 tabs.

4220 Underground Engineering

13366 **(DP-MS—88-142) The UNWRAP system: A true-color borescope-video system for inspection of tritium reservoir fill stems.** Mosley, W.C.; Kirkpatrick, R.D. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 11p. (CONF-8810159—1). NTIS, PC A03/MF A01. Order Number DE88016682/JAW.

From 3. inter-agency cleaning and contamination control seminar; Kansas City, MO, USA (18 Oct 1988).

The Savannah River Laboratory (SRL) has demonstrated the feasibility of producing undistorted true-color images of bore surface of 1/16- inch-ID stainless steel tubes using a borescope-video system. The system was assembled from commercially available components costing about $33,000. Images may be stored on magnetic disks or film for later reference. Color analyses of images can detect discoloration caused by corrosion, oxidation or contamination that could cause poor quality pinch welds. 4 figs., 2 tabs.

4230 Marine Engineering

13367 **(LBF-FB—181(1988)) Standardized load sequence for offshore structures (Wave Action Standard History) - WASH 1. Final report.** Sonsino, C.M.; Klaetschke, H.; Schuetz, W.; Hueck, M. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Darmstadt (Germany, F.R.). Inst. fuer Betriebsfestigkeit; Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (Germany, F.R.)). 1988. 96p. (IABG-TF—2347(1988)). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756402/JAW.

Offshore structures are cyclically loaded by wave action. Therefore results of fatigue tests are necessary for the assesment of their fatigue life. If one changes from the technically uncomplicated constant amplitude test to the more realistic, random-like load histories, and endless and bewildering variety of possibilities is opened up. As a result, a comparison of the the results determined in different laboratories is made more difficult. The objective was to develop and standardize a load history which is typical for the fatigue loads on offshore structures. This load history should be given a form appropriate to the state-of-the-art. In order to give the standardized load history as broad a basis as possible and to increase the acceptance both at home and abroad, a working group, the members of which come from well-known foreign and German companies, was founded in 1983. The loading of offshore structures can basically be divided into two categories, depending on whether forced or resonant vibrations are concerned (drag and inertia dominated platforms). Stiff and floating constructions belong to the first category. As the resonant frequencies here mostly are well above the exciting frequency spectrum of the waves, the vibrations are forced vibrations. The single peak frequency spectrum of the exciting waves is transmitted directly to the structure. The transmission is however non-linear with regard to wave height. In the second category large and thus less stiff structures can be placed. Here the resonant frequencies are lower and well within the exciting frequency spectrum of the waves; the structure responds in a double peak frequency spectrum. The first peak of the power spectrum is caused, as in the case of the first category, by the exciting wave spectrum, whilst the second considerably less marked peak can be put down to resonance phenomena.

13368 **(STU—83-3345) Light weight design of offshore topside steel structures.** Bond, H.; Rading, A.; Lindberg, K.; Rosendal, T.; Stark, P.O.; STU-AIB-GVA-SSAB Collaboration. (AIB, Stockholm (SE); GVA, Goeteborg (SE); SSAB, Borlaenge (SE)). (Swedish National Board for Technical Development, Stockholm). May 1985. 111p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755898/JAW.

The main weight component of the topside of an offshore structure is the structural steel. This study has been performed in order to find out how much the structural steel weight of a typical offshore topside can be reduced. In order to get a reference for comparison an already designed platform has been studied. The studies have shown that it is possible to significantly reduce the weight of the load carrying parts of conventionally designed topside steel structures by: * increase in yield strength of the steel material used, * improved stiffener arrangements, * utilizing corrugated plates. Typical weight reductions of 15-30 % were obtained by replacing the original High Strength (HS) steel having a yield stress of 325-340 MPa with Extra High Strength (EHS) steel with a yield stress of 500 MPa. The increase in dynamic stress levels due to the reduced thickness did not cause any significant fatigue problems. Modification of stiffener arrangements for the Module Support Frame were shown to significantly reduce the weight. By utilizing corrugated plates (designed with an alternative method) as walls in living quarters instead of stiffened panels a weight reduction of about 25 % was shown to be possible. The main conclusion from

the project is that it is possible to significantly reduce the steel weight of conventionally designed topside steel structures for offshore installation by utilizing steels of higher strength, and also for some parts by using corrugated walls instead of stiffened plate panels. (authors).

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 12597, 12819, 13084, 13087, 13358

43 PARTICLE ACCELERATORS

13369 **(FASAC-TAR—3110) Soviet exoatmospheric neutral particle beam research.** Leiss, J.E.; Abrams, R.H.; Ehlers, K.W.; Farrell, J.A.; Gillespie, G.H.; Jameson, R.A.; Keefe, D.; Parker, R.K. (Science Applications International Corp., McLean, VA (USA)). Feb 1988. 240p. NTIS, PC A11/MF A01.

This technical assessment was performed by a panel of eight U.S. scientists and engineers who are familiar with Soviet research through their own research experience, their knowledge of the published scientific literature and conference proceedings, and personal contacts with Soviet scientists and other foreign colleagues. Most of the technical components of a neutral particle beam generating system including the ion source, the accelerator, the accelerator radio frequency power supply, the beam conditioning and aiming system, and the beam neutralizer system are addressed. It does not address a number of other areas important to an exoatmospheric neutral beam system.

13370 **(RAL—88-050) Annual report ISIS. For the financial year 1 April 1987 to 31 March 1988.** Biggin, S. (ed.). (Rutherford Appleton Lab., Chilton (UK)). Jul 1988. 260p. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88755552/JAW.

The paper presents the 1988 Annual Report for ISIS (United Kingdom). A description is given of the accelerator and target station. The capability of ISIS is described including the facilities available and the type of science carried out using the instruments. The development and support activities are outlined, along with the ISIS organisation and user interaction. The appendix contains experimental reports on research work conducted at ISIS. (U.K.).

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 13007, 13813

13371 **(DOE/FTR—9004952) [EPAC: European Particle Accelerator Conference, Rome, Italy, June 4--11, 1988]: Foreign trip report.** Weng, W.T. (Brookhaven National Lab., Upton, NY (USA)). 18 Jul 1988. Contract AC02-76CH00016. 27p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004952/JAW.

This is the first European Particle Accelerator Conference to be held at two years interval, in contrast to the international (IPAC) series started in 1965 held every two years. It is interesting to observe that the IPAC was initiated during PS and AGS construction and USPAC was launched in the eve of FNAL approval and construction. Historically, EPAC will be remembered as created in the aftermath of the refound confidence after the discovery of W at CERN. It was openly stated that there are two reasons of starting a new series of conferences on particle accelerators. First, to balance US's domination in this field. Secondly, to provide balance between large accelerator for high energy physics and small and medium size accelerators for nuclear, material and medical uses. The Europeans regained confidence in research after three Nobel Physics prizes in a row and determined to stay in leadership position in high energy physics by being aggressive in accelerator design and construction. It is evident that there are many new projects under construction in Europe, for example, LEP, HERA, ESRF, Trieste LS, ISIS, ESR, TSR, MIMAS, COSY, CELISIUS, CRYRING, etc. They also have better cooperation with industries both in the proposal and construction of the accelerators.

13372 **(DOE/FTR—9005081) [Joint collaboration between Brookhaven/Stony Brook/Hungarian Academy of Sciences, Budapest, Hungary, and visit to Rutherford Laboratory, Chilton, England, June 2--26, 1988]: Foreign trip report.** Rhoades-Brown, M. (Brookhaven National Lab., Upton, NY (USA)). 30 Jun 1988. Contract AC02-76CH00016. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005081/JAW.

The purpose of the foreign trip detailed below, was directly related to the Relativistic Heavy Ion Collider (RHIC) project at Brookhaven. The trip was financed by an NSF exchange grant (No. INT8711985), and represents a joint collaboration between Brookhaven/Stony Brook/Hungarian Academy of Sciences. In addition to the time spent at the Centr-l Research Institute for Physics in Budapest, a visit was made on route to the Rutherford Laboratory at Chilton, England. In the full report below, details of the collaborations under way with the Central Research Institute are given. The overall conclusions from a week-long workshop at this institute on the physics of heavy ion collisions at RHIC energies, are also outlined. In addition, the highlights of discussions at the Rutherford Laboratory, and their relations to the Booster project under construction at Brookhaven are summarized.

13373 **(DOE/FTR—9006103) [4th workshop on pulse power techniques for future accelerators, Erice, Italy, March 1--10, 1988]: Foreign trip report.** Srinivasan-Rao, T. (Brookhaven National Lab., Upton, NY (USA)). 15 Apr 1988. Contract AC02-76CH00016. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006103/JAW.

The prcsent status of three different switching schemes were presented by groups involved in the research. The working groups discussed the component requirement for a high gradient accelerator, including a 1 TeV booster for a European Accelerator ELOISATRON. All the three schemes show potential and need to be pursued. The participants benefitted from exposure to experts from different fields and the open discussions facilitated by small working groups.

13374 (JINR—D-14-87-799, pp 422-430) **New pulsed μSR facility at RAL.** Stirling, G.C. (Rutherford Appleton Lab., Chilton (UK)). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

A new pulsed μSR facility is designed as a basic for the production of intense muon beams and μSR researches. It consists of high intensity 800 MeV proton synchrotron operating at pulse repetition rate of SOH/sub 2/. A feature of the design is the inclusion of an electrostatic separator for eliminating positron contamination and providing the capability of polarization rotation. Layout of the RAL muon beamline is given. The RAL muon intensity is Sx10/sup 4/ s. Demonstration histogram for an aluminium sample at 220 Gs and log-linear display of spectrum are presented. 4 refs.; 6 figs.

13375 **(LA-UR—88-2500) A high-intensity drift-tube linac with ramped accelerating gradient.** Liska, D.J.; Mignardot, H.; Billen, J.H.; Dauelsberg, L.B.; Zimmerman, G.W. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-881049—58). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005434/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Ramped accelerating gradients in drift-tube linacs are made possible by post couplers with extreme differential coupling between adjacent accelerating gaps. By bringing the energy of the beam up through ramping, better overall control of longitudinal emittance can be accomplished and a more compact accelerator achieved. Such a machine has been designed at Los Alamos and built through industrial participation with the Hanford Engineering Development Laboratory (HEDL), the Brobeck Corp., and Grumman Aerospace Corp. The design of the Ramped-Gradient Drift-Tube Linac (RGDTL) involved development of high-powered drive loops, specially instrumented drift tubes, and a new rotary-

type dynamic tuner. The assembly of the machine from the industrial components has been completed, and it is now installed and in operation at the Accelerator Test Stand (ATS) in Los Alamos. 6 refs., 7 figs.

13376 **(LA-UR—88-3231) Physics design of linear accelerators for intense ion beams.** Wangler, T.P. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-881049—57). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005435/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Advances in the physics and technology of linear accelerators for intense ion beams are leading to new methods for the design of such machines. The physical effects that limit beam current and brightness are better understood and provide the criteria for choosing the rf frequency and for determining optimum focusing configurations to control longitudinal and transverse emittances. During the past decade, the use of developments such as the radio-frequency quadrupole, multiple beams, funneling, ramped-field linac tanks, and self-matching linac tanks is leading to greater design flexibility and improved performance capabilities. 39 refs., 3 tabs., 1 fig.

13377 **(SLAC-PUB—4707) Energy scaling, crab crossing and the pair problem.** Palmer, R.B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1988. Contract AC03-76SF00515;AC02-76CH00016. 7p. (CONF-8806243—25; CONF-8806258—4). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006011/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

Making reasonable assumptions, the luminosities of linear colliders are calculated for center-of-mass energies of 10 GeV, 100 GeV and 1 TeV. A calculation is also mode for a 1/2 TeV collider that could be upgraded to 1 TeV later. The improvements possible using "crab-like" crossing are also given. 4 refs., 4 figs., 3 tabs.

13378 **(UTTAC—54) Annual report of the Tandem Accelerator Center, University of Tsukuba, 1987. April 1, 1987 - March 31, 1988.** (Tsukuba Univ., Sakura, Ibaraki (Japan). Tandem Accelerator Center). Jul 1988. 145p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756579/JAW.

This annual report covers the research activities and technical developments of the Tandem Accelerator Center, University of Tsukuba, in the period from April, 1987 to March, 1988. In the field of nuclear physics, the elastic and inelastic scattering of polarized protons from even-even medium weight nuclei was investigated systematically by light ion beam experiment. A QDQ type mag netic spectrograph for double scattering experiment was almost complete. The studies on heavy ion-induced fission reaction advanced by measuring anisotropy in fission angular distribution, and a view on the mechanism of the reaction was acquired. A new, ingenious technique enabled to identify prompt characteristics X-ray accompanying the fusion reaction induced by heavy ions. In the field of atomic and solid state physics, a strange dependence of equilibrium charge state on the atomic number of projectile heavy ions has been elucidated. The research on ion beam shadowing effect on the emission of ion-induced secondary electrons was continued. The Rutherford backscattering of O/sup 4+/ ions was applied to determine the composition of Y-Ba-Cu oxide film, and it shed light on the condition governing the nature of superconductive materials. The 12 UD Pelletron was operated quite satisfactorily. (Kako, I.).

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 13387, 13403, 13407, 13863, 14054

13379 **(ANL-HEP-CP—88-78) Polarized proton and anti-proton experiments at Fermilab E-581/704.** Yokosawa, A. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 13p. (CONF-880983—30). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005869/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

We summarize activities concerning the Fermilab polarized beams. They include a description of the polarized-beam facility, measurements of beam polarization by polarimeters, asymmetry measurements in the π^0 production at large x, and experiments with polarized beams during the next fixed-target period. 8 refs., 9 figs.

13380 **(BNL—41950) Operation of the AGS polarized beam.** Ahrens, L.A. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 9p. (CONF-880983—27). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005643/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

A polarized proton physics run took place during January, 1988, at the Brookhaven AGS. It is the purpose of this paper to review the tune-up period preceding that run. This was the third such run at the AGS; the others occurred in June of 1984 and February of 1986. Some comparisons will be drawn among these. A thorough review of the history and hardware associated with the acceleration of polarized protons at the AGS can be found in the proceedings of the last meeting of this group at Protvino and will not be repeated here. 2 refs., 6 figs., 1 tab.

13381 **(BNL—52171) Synchronous particle and bucket dynamics.** Kats, J.M. (Brookhaven National Lab., Upton, NY (USA)). 3 Oct 1988. Contract AC02-76CH00016. 31p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006402/JAW.

In accelerator theory of particle longitudinal motion, a classical definition if a synchronous particle (synchronous energy, synchronous phase, synchronous orbit) assumes that there is a one-to-one relationship of the accelerator electrical field. In practice, that relationship may not be sustained because of errors in the magnetic field, radio frequency, or because sometimes we do not want to keep that relationship for some reason. In this report we formulate the concept of adiabatic equilibrium between particle and accelerator, and we introduce a definition of synchronous particle when the magnetic field and radio frequency are independent functions of time. The result is that size and shape of the bucket (separatrix) depends not only on the fields rate of change {dot B}, but on the frequency rate {dot f} as well. This means, for example, we can have a stationary bucket even at the rising field {dot B} > 0. Having a frequency f in addition to field B and voltage V as parameters controlling the bucket dynamics, we will show how to decrease particle losses during injection and capture. 6 refs., 7 figs.

13382 **(JINR—D-14-87-799, pp 233-234) New acceleration principle for μ revitalization.** Daniel, H. (6134633DE). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

A new acceleration principle for μ revitalization is suggested. The equation of ion motion in matter under the action of magnetic and electric fields with multiple ion scattering taken into account is analyzed for a μ/sup 4/He/sup +/ cyclotron. Being continuously accelerated in vacuo during one tenth of its life time the μ/sup 4/He/sup +/ ion would reach 96 MeV. The "pincers" are proposed which may offer the feasibility of a self-sustaining fusion reactor based on M-catalyzed fusion. The technical difficulties are assumed to be enormous. 3 refs.; 1 fig.

13383 **(LA-UR—88-3301) High-order beam optics: An overview.** Heighway, E.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-881049—60). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005441/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Beam-transport codes have been around for as long as thirty years and high-order codes, second-order at least, for close to twenty years. Before this period of design-code development, there was considerable high-order treatment, but it was almost entirely analytical. History has a way of repeating itself, and the current excitement in the field of high-order optics is based on the application of Lie algebra and the so-called differential algebra to beam-transport codes, both of which are highly analytical in foundation. Some of the main design tools available today will be described, giving a little of their history, and will conclude by trying to convey some of the excitement in the field through a brief description of Lie and differential algebra. 30 refs., 7 figs.

13384 **(SLAC-PUB—4537) Controlling multibunch beam breakup in TeV linear colliders.** Thompson, K.A.; Ruth, R.D. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jan 1989. Contract AC03-76SF00515. 16p. (CONF-8806258—3; SLAC/AP—64). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006008/JAW.

From Workshop on physics of linear colliders; Capri, Italy (13 Jun 1988).

To obtain luminosities near 10^{34}cm/sup {minus}2/sec/sup {minus}1/ in a TeV linear collider, it will probably be essential to accelerate many bunches per RF fill in order to increase the energy transfer efficiency. In this paper we study the transverse dynamics of multiple bunches in a linac, and we examine the effects of several methods of controlling the beam blow-up that would otherwise be induced by transverse dipole wake fields. The methods we study are: damping the transverse modes, adjusting the frequency of the dominant transverse modes so that bunches may be placed near zero-crossings of the transverse wake, and bunch-to-bunch variation of the transverse focusing. We study the utility of these cures in the main linacs of an example of a TeV collider. 16 refs., 4 figs., 2 tabs.

13385 **(SLAC-PUB—4800) Multibunch instabilities in subsystems of 0.5 and 1.0 TeV linear colliders.** Thompson, K.A.; Ruth, R.D. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1988. Contract AC03-76SF00515. 7p. (CONF-8806243—18). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005965/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

The acceleration of multiple bunches per RF fill of the linac accelerating structures is an important feature of the SLAC design for a next-generation linear collider, in order to use the RF as efficiently as possible and to obtain a higher luminosity. In this paper, we give simulation results on the control of multibunch instabilities in the subsystems of a 1.0 TeV linear collider (TLC) and an "intermediate" linear collider (ILC) of about 0.5 TeV center of mass energy. 4 refs., 4 figs., 11 tabs.

13386 **(SLAC-PUB—4806) Final focus system for TLC.** Oide, K. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1988. Contract AC03-76SF00515. 6p. (CONF-8806243—23). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006069/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

A limit of the chromaticity correction for the final focus system of a TeV Linear Collider (TLC) is investigated. As the result, it becomes possible to increase the aperture of the final doublet with a small increase of the horizontal β function. The new optics design uses a final doublet of 0.5 mm half-aperture and 1.4 T pole-tip field. The length of the system is reduced from 400 m to 200 m by several optics changes. Tolerances for various machine errors with this optics are also studied. 5 refs., 7 figs., 2 tabs.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 12747, 13093, 13330, 13379, 13447

13387 **(ANL-HEP-CP—88-70) The Fermilab polarized beam snake.** Underwood, D.G. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 5p. (CONF-880983—31). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005867/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

We describe the design and operation of spin rotators in the Fermilab polarized beam. The two modes of operation transform horizontal polarization to longitudinal or vertical. These can be considered partial snakes of type II and type I, respectively. The required magnet properties are also discussed. 3 refs., 2 figs.

13388 **(BNL—41974) Optimization of multiwire coil ends having 45 degree bends.** Morgan, G.H. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 3p. (CONF-880812—33). NTIS, PC A02 - OSTI. Order Number DE89005767/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

Multiwire is the name of a proprietary process for affixing small diameter wires to a flat substrate using digitally controlled machinery. It is currently being used to wind trim coils for the SSC dipoles on a flexible substrate which is wrapped around the beam tube. It is proposed for making multipole coils for the Corrector, a regular arc magnet in each half-cell of the Relativistic Heavy Ion Collider (RHIC). The current Multiwire process does not permit a change in direction of the wire other than 45 degree. The present paper answers the question of whether the 45 degree bends in the flattened coil can be located along straight lines in such a way as to eliminate or reduce higher harmonics in the ends. The more general question of bends located along curves is not addressed. 3 refs., 3 figs., 2 tabs.

13389 **(CONF-880983—32) Tests of a polarized source of hydrogen and deuterium based on spin-exchange optical pumping and a storage cell for polarized deuterium.** Holt, R.J.; Gilman, R.; Kinney, E.R.; Kowalczyk, R.S.; Napolitano, J.; Young, L.; Mishnev, S.I.; Nikolenko, D.M.; Popov, S.G.; Rachek, I.A. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005891/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

A novel laser-driven polarized source of hydrogen and deuterium which is based on the principle of spin-exchange optical pumping has been developed at Argonne. The advantages of this method over conventional polarized sources for internal target experiments is discussed. At present, the laser-driven polarized source delivers hydrogen 8 x 10^{16} atoms/s with a polarization of 24% and deuterium at 6 x 10^{16} atoms/s with a polarization of 25%. A passive storage cell for polarized deuterium was tested in the VEPP-3 electron storage ring. The storage cell was found to increase the target thickness by approximately a factor of three and no loss in polarization was observed. 10 refs., 4 figs., 2 tabs.

13390 **(CONF-8806101—8) Experimental studies of electron beam transport in the Maryland periodic solenoid channel.** Kehne,, D.; Low, K.; Reiser, M.; Shea, T.; Chang, C.R.; Chen, Y. (Maryland Univ., College Park (USA)). 1988. Contract AC05-85ER40216. 9p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005399/JAW.

From International symposium on heavy ion inertial fusion; Darmstadt, F.R. Germany (28 Jun 1988).

In the University of Maryland electron beam transport experiment, a 5 kV, 0.2 A electron beam from a thermionic electron source (cathode radius r/sub c/ = 1.27 cm and cathode temperature kT = 0.12 eV) is injected into a periodic focusing channel consisting of 38 solenoid lenses with period length S = 13.6 cm.

The magnetic focusing fields of the channel, and hence the phase advance without space charge, can be varied over a wide range. We report emittance measurements and results of the effects of beam mismatch, misalignments, and nonlinear lens forces on beam transport and emittance growth. 9 refs., 4 figs.

13391 **(DOE/FTR—9004961) [Attend the European Particle Accelerator Conference, and present the following papers: the new AGS H/sup {minus}/ RFQ preinjector, and advances in BNL's polarized ion source development, Rome, Italy, June 7--11, 1988]: Foreign trip report.** Alessi, J.G. (Brookhaven National Lab., Upton, NY (USA)). 6 Jul 1988. Contract AC02-76CH00016. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004961/JAW.

In addition to presenting the above papers, the conference program included many topics which are very relevant to my work at Brookhaven. The full report which follows will contain some specific information both from presentations and private discussions related to my present work on ion source development and RFQ preinjectors. It also contains some comments on the present status of several accelerators.

13392 **(DOE/FTR—9005075) [Attend 3rd European workshop on the production and application of light negative ions, sites visited were the University of Amsterdam, Amsterdam, The Netherlands, Eindhoven Universities, Eindhoven, The Netherlands, Euroase Congress Center, Amersfoort, The Netherlands, CENS, Gif-Sur-Yvette, France, and University de Paris Sud, Orsay, France, February 13--28, 1988]: Foreign trip report.** Hershcovitch, A. (Brookhaven National Lab., Upton, NY (USA)). 4 Apr 1988. Contract AC02-76CH00016. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005075/JAW.

All the stated purposes of the trip were accomplished. At the negative ion workshop, the traveler presented three papers on BNL research in this field, and the traveler acquired knowledge regarding the state-of-the-art of H/sup {minus}/ ion sources. The traveler gave an invited talk in a physics colloquium at the University of Amsterdam on cold atomic beams and the traveler presented his latest experimental results to experts in this field from the University of Amsterdam and CEN-Saclay. Their comments on the experimental results provided the traveler with insight and guidance for future work especially on the use of superconducting solenoids for focusing. During this trip a crucial part of the international symposium on EBIS devices to be held November 14-18, 1988, at BNL was planned with Dr. J. Faure. In addition, the traveler discussed the BNL interest in EBIS devices with experts on these machines, as well as on the BNL approach to extract high brightness, large current e-beams from an HCD.

13393 **(DOE/FTR—9005083) Visits to INFN, LMI and BBC, INFN Superconductivity Laboratory, Genoa Italy, LMI, Florence, Italy, BBC Superconducting Laboratory, Zurich, Switzerland, DESY HERA project, Hamburg, West Germany, March 21--April 6, 1988: Foreign trip report.** Garber, M. (Brookhaven National Lab., Upton, NY (USA)). 3 Apr 1988. Contract AC02-76CH00016. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005083/JAW.

The INFN facility in Genoa is nearly ready for regular testing of superconducting cables for the HERA project. At the initiative of DESY this visit was made in order to evaluate their work and compare results with BNL. Trips to LMI and BBC proved to be interesting and useful adjuncts to the Genoa visit. LMI has merged with a French company and is now called Europa Metalli it is now the largest producer of finished cooper products in the world. BBC was recently acquired by ASEA of Sweden and is now called ABB. In this report I will call them by their old names, however.

13394 **(DOE/FTR—9005913) [Discuss Booster vacuum system processing and study CERN PS vacuum systems, Geneva, Switzerland, and review manufacturing specification of the Booster dipole chambers with the vendor, E. Zanon, SpA, Schio, Italy, October 9--16, 1988]: Foreign trip report.** Hseuh, H.C.; Savino, J. (Brookhaven National Lab., Upton, NY (USA)). 1 Nov 1988. Contract AC02-76CH00016. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005913/JAW.

This report contains information and observations on CERN PS vacuum systems pertinent to the construction of the Booster vacuum system; and the discussion of the fabrication of the Booster dipole vacuum chambers with E. Zanon, SpA.

13395 **(FNAL/C—88/194) Thermal performance measurements of a graphite tube compact cryogenic support for the Superconducting Super Collider.** Gonczy, J.D.; Boroski, W.N.; Larson, E.T.; Nicol, T.H.; Niemann, R.C.; Otavka, J.G.; Ruschman, M.K. (Fermi National Accelerator Lab., Batavia, IL (USA)). Dec 1988. Contract AC02-76CH03000. 8p. (CONF-880736—5). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006139/JAW.

From 12. international cryogenic engineering conference and exhibition; Southampton, United Kingdom (12 Jul 1988).

The magnet cryostat development program for the Superconducting Super Collider (SSC) High Energy Physics Proton-Proton Collider has produced an innovative design for the structural support of the cold mass and thermal radiation shields. This work updates the continuing development of the support known as the Compact Cryogenic Support (CCS). As the structural and thermal requirements of the SSC became better defined, a CCS was developed that employs an innermost tube comprised of a graphite composite material. Presented is the thermal performance to 4.5K of the graphite CCS model. 8 refs., 6 figs., 2 tabs.

13396 **(FNAL-TM—1549) Report on full-scale horizontal cable tray fire tests, FY 1988.** Riches, W.M. (Fermi National Accelerator Lab., Batavia, IL (USA)). Sep 1988. Contract AC02-76CH03000. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005996/JAW.

In recent years, there has been much discussion throughout industry and various governmental and fire protection agencies relative to the flammability and fire propagation characteristics of electrical cables in open cable trays. It has been acknowledged that under actual fire conditions, in the presence of other combustibles, electrical cable insulation can contribute to combustible fire loading and toxicity of smoke generation. Considerable research has been conducted on vertical cable tray fire propagation, mostly under small scale laboratory conditions. In July 1987, the Fermi National Accelerator Laboratory initiated a program of full scale, horizontal cable tray fire tests, in the absence of other building combustible loading, to determine the flammability and rate of horizontal fire propagation in cable tray configurations and cable mixes typical of those existing in underground tunnel enclosures and support buildings at the Laboratory. The series of tests addressed the effects of ventilation rates and cable tray fill, fire fighting techniques, and effectiveness and value of automatic sprinklers, smoke detection and cable coating fire barriers in detecting, controlling or extinguishing a cable tray fire. This report includes a description of the series of fire tests completed in June 1988, as well as conclusions reached from the test results.

13397 (JINR—D-14-87-799, pp 437-441) **Experimental complex for μSR study at NPL JINR phasatron.** Gaganov, I.A.; Grebinnik, V.G.; Duginov, V.N. and others. 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

An equipment complex for conducting MSR-experiments in the JINR phasatron muon beams is described. The experimental complex comprises armored electromagnets, superconducting solenoids, a set of cryostats for obtaining 4.2-300 K temperatures, refrigerator for /sup 3/He dissolution in /sup 4/He, the system of temperature regulation and magnetic field measurement time spec-

troscopy equipment. The complex developed allows one to conduct sample measurements at 0.05-300 K temperatures and external magnetic fields of up to 6.4 T. Experiment control, data accumulation and processing are performed by calculaion-metering MERA-125 minicomputer-base system. 6 refs.; 4 figs.

13398 **(LA-UR—88-3267) An rf-driven lasertron.** Tallerico, P.J.; Sheffield, R.L.; Cornelius, W.D.; Gray, E.R.; Wilson, M.T.; Nguyen, D.C.; Meier, K.L.; Stockley, R.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 3p. (CONF-881049—56). NTIS, PC A02 - OSTI. Order Number DE89005436/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

An rf-driven lasertron has been built and is being tested. It is designed to produce over 1 MW of power at 1.3 GHz, with over 60% conversion efficiency between the beam's kinetic energy and microwaves. The design and experiment are discussed, and calculations are presented that show lasertrons can operate at frequencies up to 20 GHz. 3 refs., 5 figs.

13399 **(LA-UR—88-3288) On the horizon: New rf power sources for linear accelerators.** Reid, D.W. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-881049—55). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005437/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

In the past, linear accelerators at frequencies below 3 GHz have been driven by klystrons or gridded tubes, with most of the small electron accelerators using conventional magnetrons. During the past few years, there have been several new rf amplifier developments that could be advantageous to the linear accelerator designer. Among these new devices are the cathode-driven crossed-field amplifier, Klystrode, high-power solid-state amplifier, lasertron, multiple-beam klystron, phase-locked magnetron, and a depressed collector for a high-power klystron. All of these devices are being worked on at this time. Each can contribute to a linear accelerator system by supplying better efficiency, lower cost, higher power, or longer life. This paper will review the present status of each device and, where current test data are available, they will be reviewed. 19 refs., 13 figs.

13400 **(LA-UR—88-3289) Synchronous phase and energy measurement system for a 6.7-MeV H^- beam.** Gilpatrick, J.D.; Meyer, R.E.; Wells, F.D.; Power, J.F.; Shafer, R.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-881049—63). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005438/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

A noninterceptive measurement system has been built to measure the energy and synchronous phase of a 6.7-MeV proton beam drifting from the ramped-gradient, drift-tube linac (RGDTL) in the accelerator test stand (ATS) facility. Axially-symmetric, capacitive probes used in these measurements produce signals that are proportional to the beam image current on their inner rings. Signals from two of these probes separated by 92.6 cm are down-converted from 425 to 20 MHz. The phase difference between these 20-MHz signals is then detected with an electronic, phase-comparator circuit. The phase-comparator signal output is a voltage that is related to momentum of the beam. A phase comparison is also provided between the 425-MHz fundamental rf field inside the RGDTL and the capacitive probe located nearest the RGDTL output. The total estimated error for the absolute and relative energy measurement is less than +- 12.2 and +- 3.1 keV, respectively. The total estimated error for the relative synchronous phase measurement is less than +-1{degree}. Beam energy versus synchronous phase experimental data agree with computer simulations. 3 refs., 3 figs., 1 tab.

13401 **(LA-UR—88-3290) Pulsed H^- beams from Penning SPS [Surface-Plasma Sources] sources equipped with circular emitters.** Smith, H.V. Jr.; Sherman, J.D.; Allison, P. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-881049—62). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005439/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

We report the H^- beam currents and emittances produced when Penning Surface-Plasma Sources (SPS), equipped with circular emitters, are pulsed at {approximately}1% duty factor. Two sources are now under investigation: the small-angle source (SAS) and the 4X source. The 4X source is designed to test the plasma scaling laws for Penning SPS; SAS is the 1X device. The 0.16 cm^3 discharge volume of the SAS is {approximately}30 times smaller than that of the 4X source, 4.6 cm^3. With a 0.25-cm-diam circular emitter, the SAS produces 82 mA of 27-keV H^- beam with normalized rms emittance of 0.0053 x 0.0056 (π{center←dot}cm{center←dot}mrad)^2. With a 0.26-cm-diam circular emitter, the 4X source produces 50 mA of 29-keV H^- beam with emittance of 0.0049 x 0.0050 (π{center←dot}cm{center←dot}mrad)^2. The measured data are compared with the predictions of the ion-optical code SNOW. 10 refs., 7 figs., 1 tab.

13402 **(LA-UR—88-3300) Design and construction of a 425-MHz cryogenic (20K) two-cell DTL [drift-tube linac] sparker.** Wilson, N.G.; Bolme, G.O.; Kalash, K. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-881049—61). NTIS, PC A02 - OSTI. Order Number DE89005440/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

A two-cell 425-MHz drift-tube linac (DTL) "sparker" for operation at 20 K has been designed and constructed to operate at >2 Kilpatrick accelerating voltage while transporting an H/sup {minus}/ 5-MeV beam at currents up to 100 mA. Permanent-magnet quadrupole (PMQ) assemblies are installed in the input/output beam-transport system and in the cryogenically cooled cavity drift-tube and two half-cells. The cavity, cooled by a 700-W cold-helium gas refrigerator, is mounted inside a superinsulated high-vacuum chamber that is evacuated by a 360-{ell}/s turbomolecular vacuum-pump system. The cavity components (slug tuner, post coupler, drive loop) are fabricated from electropolished OFHC possessing a residual resistivity ratio of >200. The rf contacts for the cavity end walls are copper-plated Inconel X-750 C-seals. The drift-tube stem, post-coupler stem, and slug tuner use gold-plated beryllium/copper Multilam bands rf contacts. Initial experiments at 20 K have shown a cavity Q enhancement of 4-5. The experimental program includes characterization of the rf cavity beam loading, engineering design and construction, and thermal system response. 11 refs., 2 figs.

13403 **(LA-UR—88-3327) Photoelectric injector design considerations.** Carlsten, B.E.; Sheffield, R.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-881049—53). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005444/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

We will present an analysis for different emittance growth mechanisms for electron beams in photoelectric injectors. The mechanisms will be broken up into three groups: space-charge forces due to self-similar expansion, space-charge forces due to non-self-similar expansion (including divergences and convergences of the beam), and rf forces. We will show that some of the emittance can be eliminated downstream, particularly that of the first group. General design considerations will become clear from this analysis and a generic design will be presented. In addition, a photoelectric injector design for both the Los Alamos National Laboratory XUV FEL and a compact free-electron laser (FEL) will be used to show a numerical agreement with the analysis. 5 refs., 2 figs.

13404 **(SLAC-PUB—4706) A cluster klystron.** Palmer, R.B.; Miller, R. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1988. Contract AC02-76CH00016;AC03-76SF00515. 6p. (CONF-8806243—26). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006010/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

We consider a honeycomb-like array of 126 individual klystrinos all fed from a single high-voltage source and all focused by a single axial magnetic field. It is argued that such a device may be a practical and economic power source for a TeV Linear Collider. It could be used either as a source of 1/2 μsec rf pulses to be binary pulse compressed or, with a grid cathode and oil line energy storage, as a direct source of power. 7 refs., 7 figs., 1 tab.

13405 **(SLAC-PUB—4802) Bunch compression for the TLC: Preliminary design.** Kheifets, S.A.; Ruth, R.D.; Murray, J.J.; Fieguth, T.H. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1988. Contract AC03-76SF00515. 4p. (CONF-8806243—24). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006068/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

A preliminary design of a TLC bunch compressor as a two-stage device is described. The main parameters of the compressor, as well as results of some simulations, are presented. They show that the ideal system (no imperfections) does the job of transmitting transverse emittances without distortions (at least up to the second-order terms) producing at the same time the desired bunch length of 50 μm. 9 refs., 6 figs., 4 tabs.

13406 **(SLAC-PUB—4803) RF pulse compression and alternative RF sources for linear colliders.** Wilson, P.B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1988. Contract AC03-76SF00515. 3p. (CONF-8806243—22). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006070/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

Future linear colliders will require a very high peak power per meter of accelerating structure at a relatively high frequency{endash}greater than 10 GHz{endash}but at a relatively short pulse length{endash}less than 100 ns. One technique for generating the required peak power is to use a more or less conventional microwave power source, which produces power at a pulse length typically on the order of 1 μs, together with RF pulse compression. Some parameters are given for a Binary Power Multiplier (BPM) pulse compression system operating at 17.1 GHz with an output pulse length of 60 ns. The peak power gain for a three stage system is estimated to be 6.6 (82% compression efficiency). Some possible long-pulse microwave sources which{endash}when coupled with such a pulse compression system{endash}would be suitable for driving a linear collider are briefly discussed. 13 refs., 1 fig., 1 tab.

13407 **(SLAC-PUB—4808) Damping ring designs for a TeV Linear Collider.** Raubenheimer, T.O.; Rivkin, L.Z.; Ruth, R.D. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1988. Contract AC03-76SF00515. 13p. (CONF-8806243—19). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005962/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

In this paper we present a damping ring design for the TLC (TeV Linear Collider). The ring operates at 1.8 GeV. It has normalized emittances of $\gamma\epsilon_x = 2.8$ μmrad and $\gamma\epsilon_y = 25.4$ nmrad. The damping times are $\tau_x = 2.5$ ms and $\tau_y = 4.0$ ms. To achieve these extremely low emittances and fast damping times, the ring contains 22 m of wigglers. 30 refs., 7 figs., 7 tabs.

13408 **(SLAC-PUB—4820) Radio frequency pulse compression.** Farkas, Z.D. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1988. Contract AC03-76SF00515. 7p. (CONF-8806258—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005967/JAW.

From Workshop on physics of linear colliders; Capri, Italy (13 Jun 1988).

High gradients require peak powers. One possible way to generate high peak powers is to generate a relatively long pulse at a relatively low power and compress it into a shorter pulse with higher peak power. It is possible to compress before dc to rf conversion as is done for the relativistic klystron or after dc to rf conversion as is done with SLED. In this note only radio frequency pulse compression (RFPC) is considered. Three methods of RFPC will be discussed: SLED, BEC, and REC. 3 refs., 8 figs., 1 tab.

13409 **(SLAC-PUB—4845) Rf breakdown and field emission.** Loew, G.A.; Wang, J.W. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jan 1989. Contract AC03-76SF00515. 3p. (CONF-8806243—20). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005943/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

One of the crucial parameters in the design of TeV e/sup +-/ linear colliders is the maximum electric field gradient that can be attained and used safely in the accelerating structure. In the absence of definitive knowledge on the availability and cost of rf power sources, the optimum machine length for a given energy cannot be determined at this time. However, the designs considered in this report could require gradients as high as 200 MV/m at rf frequencies of 11.424 GHz or 17.136 GHz, corresponding to peak powers of up to 1 GW/m. On the basis of research done at SLAC and at Varian, it now appears that such gradients are reachable, at least in short standing-wave (SW) structures. Considerably more work, however, is needed to determine if the required gradients are achievable in long and complicated structures, and to verify that the accompanying field emitted currents which can absorb power, cause parasitic wakefields and spurious x-rays along the accelerator, are tolerable. 1 ref., 1 fig.

13410 **(UCRL—99820) ATA [Advanced Test Accelerator] beam transport experiment: Optical data.** Chong, Y.P.; Lee, P.; Deadrick, F.J.; Hirzel, D.G.; Kallman, J.S.; Poulter, J.F.; Rivera, W.E.; Stephan, P.L. (Lawrence Livermore National Lab., CA (USA)). 1 Oct 1988. Contract W-7405-ENG-48. 17p. (CONF-8809149—26). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005352/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

Optical data showing emittance growth through the Advanced Test Accelerator (ATA) beam pulse have been obtained using a new beam profile diagnostic, Cerenkov radiation emitted from a quartz foil inserted into the path of the electron beam. This diagnostic gave extremely bright optical emissions which allowed productive operation of a streak camera in addition to the gated 2-D image-intensified CCD TV cameras previously used. Measurements were made at cells 15 ({approximately}3.75 MeV), cell 90 ({approximately}22.5 MeV) and 11 m beyond the accelerator ({approximately}43 MeV). In particular, it was possible to measure beam profiles inside the ion channel where the beam was so tightly pinched that the current density exceeded the damage threshold of previous foils (titanium and kapton). Double-Gaussian fits to the transverse beam profile were often found to be better than a single Gaussian fit. Two-component beams were observed for the 3-kA case at cell 15 and for the 1-, 3-, and 7-kA cases at 11 m. At cell 15, the large-beam component carried an increasing fraction of beam current starting from the middle of the pulse. 13 figs.

13411 **(UCRL—99875) Relativistic klystron experimental results.** Westenskow, G.A. (Lawrence Livermore National Lab., CA (USA)). 27 Oct 1988. Contract W-7405-ENG-48;AC03-76SF00515;AC03-76SF00098. 7p. (CONF-8809149—27). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005653/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

Relativistic klystrons are being developed as a power source for high-gradient accelerator applications which include compact accelerators, large linear electron-positron colliders, and FEL sources. We have attained 200 MW peak power at 11.4 GHz from a relativistic klystron, and 140 MV longitudinal gradient in a short 1.4-GHz accelerator section. We report here on the design of our first klystrons, the results of our experiments so far, and some of our plans for the near future. 4 refs., 1 fig., 1 tab.

13412 **Pulsed particle beam vacuum-to-air interface.** Cruz, G.E.; Edwards, W.F. US Patent Application 6-063,603. 18 Jun 1987. 25p. Contract W-7405-ENG-48. DE89000135 NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE89000135/JAW.

A vacuum-to-air interface is provided for a high-powered, pulsed particle beam accelerator. The interface comprises a pneumatic high speed gate valve, from which extends a vacuum-tight duct, that terminates in an aperture. Means are provided for periodically advancing a foil strip across the aperture at the repetition rate of the particle pulses. A pneumatically operated hollow sealing band urges foil strip, when stationary, against and into the aperture. Gas pressure means periodically lift off and separate foil strip from aperture, so that it may be readily advanced. 5 figs.

4304 Storage Rings

13413 **(DOE/FTR—9004955) [Symposium/workshop on the applications of synchrotron radiation, Beijing, China, participate in the steering committee meeting of the US-Japan Cooperative Program on neutron scattering, Tokyo, Japan, May 23--June 10, 1988]: Foreign trip report.** Blume, M. (Brookhaven National Lab., Upton, NY (USA)). 29 Jun 1988. Contract AC02-76CH00016. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004955/JAW.

The Institute for High Energy Physics, Beijing organized a Workshop on Applications of Synchrotron Radiation in preparation for the start-up of their synchrotron radiation program at the Beijing Electron Positron Collider (BEPC). The two-week symposium, at which the author lectured and chaired a session, was attended by scientists from many institutes in China. In addition, the author discussed the commissioning of the BEPC storage ring and discussed the fabrication of linear accelerator sections being carried out under the US-China Cooperative Program in High Energy Physics. The author discussed the possibility of fabrications of additional sections by the Chinese. The author also visited the Institute for Atomic Energy, inspected their reactor and discussed their neutron scattering program. In Japan the author attended the Steering Committee meeting of the US-Japan Cooperative Program on Neutron Scattering, visited Tokyo University and the Photon Factory Synchrotron Radiation Source, the TRISTAN high energy storage ring and the neutron and medical research programs at the Institute for High Energy Physics (KEK) in Tsukuba.

13414 **(DOE/FTR—9005073) [Discussion on design and construction of a storage ring magnet, Fuji Electric Co., Tokyo, Furukawa Electric Co., Yokohama, and New Japan Steel Co., Nagoya, Japan, January 23--January 31, 1988]: Foreign trip report.** Cullen, J.R. (Brookhaven National Lab., Upton, NY (USA)). 29 Mar 1988. Contract AC02-76CH00016. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005073/JAW.

The purpose of this trip was to discuss various technical aspects and approaches to be used in the design and construction of a storage ring magnet. This magnet will be used in the Muon g-2 experiment to be performed at BNL. As the size of these magnets grows larger, it becomes increasingly more difficult to manufacture off-site and transport the finished product to the site. On-site construction becomes necessary and it is of great interest to US magnet builders to learn this technology thereby allowing on-site construction of this type of magnet coil. This is a follow-up meeting to a visit made by our Japanese colleagues in September, 1987. During the trip, mainly technical discussions were held with KEK personnel. At Fuji Electric discussions related to coil winding tooling while conductor handling and its specification were discussed at Furukawa Electric. Yoke steel and its magnetic properties were considered at New Japan Steel.

13415 **(INS-T—481) Discriminator/Divider module for anode readout of the TOPAZ Inner Drift Chamber.** Imanishi, A.; Masuda, H.; Ishii, T.; Kono, K.; Norimura, K.; Ohshima, T.; Okuno, H.; Shiino, K.; Ukai, K. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jun 1988. 22p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756546/JAW.

The Discriminator/Divider module for anode readout of the TOPAZ Inner Drift Chamber has been developed. A single-span wide-CAMAC module can process 32-channel differential signals from the anode preamplifiers. The module provides two kinds of output signals; one is the ECL differential signal for the drift time measurement with the LeCroy TDC system and the other is the TTL logic signal for triggering with the Rphi Line Search module. Threshold levels of discriminators can be controlled through the standard CAMAC data way in the input voltage range from 10 mV to 500 mV. Test pulse outputs with variable amplitudes and +-5.2 V power lines are also provided for the preamplifier cards.

13416 **(INS-T—482) Rphi-LINE-SEARCH module for track trigger with the TOPAZ Inner Drift Chamber.** Imanishi, A.; Masuda, H.; Ishii, T.; Kono, K.; Norimura, K.; Ohshima, T.; Okuno, H.; Shiino, K.; Ukai, K. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jun 1988. 28p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756547/JAW.

The Rphi-LINE SEARCH module for charged-particle track trigger with the TOPAZ Inner Drift Chamber(IDC) has been developed. The double-span wide-CAMAC module provides trigger signal by the table-look-up method using the 16 kbit Static-RAM from the IDC hit pattern data. Mask pattern data on the look-up table is down-loaded from the online computer via FASTBUS/CAMAC dataway, which should be decided depending on the beam condition. In the actual experiment, this module's output is used for the fast decision (pre-trigger) of the charged-particle track trigger in the TOPAZ trigger system, which has been employed to open the gating grid of the Time Projection Chamber(TPC). A decision time of this module is less than 130 ns.

13417 **(LA-UR—88-4033) Design for a second-generation proton storage ring at LAMPF.** Colton, E.P. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-8810182—10). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005450/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

A conceptual design is presented for a second-generation proton storage ring complex at LAMPF. The facility would consist of two stacked racetrack-shaped machines. These machines would deliver a 1.2-mA beam of 1.6-GeV protons at 48 Hz. The pulse length would be 1.75 μsec which represents a time compression of 570. 1 ref., 8 figs., 1 tab.

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REFER ALSO TO CITATION(S) 12748, 12904, 13225, 13242, 13415, 13416, 13450, 13797, 13856, 13862, 13904, 14094

13418 **(ANL-HEP-CP—88-59) Calorimetry in ZEUS: Lessons for the future.** Derrick, M. (Argonne National Lab., IL (USA). High Energy Physics Div.). 1988. Contract W-31109-ENG-38. 7p. (CONF-8806243—16). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number TI89005825/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

The storage ring facility HERA, under construction at the DESY Laboratory, will collide 30 GeV e/sup {minus}/ with 820 GeV protons when the machine is first turned on in 1990. Four interaction regions being provided. Subsequently either e/sup {minus}/ or e^+ beams can be used and a facility for producing longitudinal polarization of the electrons at the interaction points will be provided. Both the center-of-mass energy ($\sqrt{s}$ = 314 GeV) and the momentum transfer (Q/sub max/^{2} {approximately} 10^5 GeV^2) are substantially higher than in any deep inelastic scattering studies to date. The HERA program will be the natural extension of both the neutrino and the muon scattering experiments done at CERN and Fermilab. With the design luminosity of 1.5 10^{31} cm/sup {minus}2/ sec/sup {minus}1/ experiments with 200 pb/sup {minus}1/ of integrated luminosity will be possible. HERA will be the first electron-quark collider. The energy is substantially higher than LEP, and the events will be cleaner than those resulting from p{bar p} collisions. It provides the third leg that will support the physics stool of the 1990s. In neutral current events, the z exchange graph is comparable in strength to the photon exchange and the charged current events will provide unique insights into the W coupling. There will be substantial rates of heavy quark production. Two detectors are under construction: H1 uses a large solenoid with a liquid argon calorimeter inside the coil, ZEUS uses a smaller magnet with uranium-scintillator calorimeters outside of the coil. 4 refs., 11 figs.

13419 **(BNL—42147) Spiral silicon drift detectors.** Rehak, P.; Gatti, E.; Longoni, A.; Sampietro, M.; Holl, P.; Lutz, G.; Kemmer, J.; Prechtel, U.; Ziemann, T. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 8p. (CONF-881103—29). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005770/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

An advanced large area silicon photodiode (and x-ray detector), called Spiral Drift Detector, was designed, produced and tested. The Spiral Detector belongs to the family of silicon drift detectors and is an improvement of the well known Cylindrical Drift Detector. In both detectors, signal electrons created in silicon by fast charged particles or photons are drifting toward a practically point-like collection anode. The capacitance of the anode is therefore kept at the minimum (0.1pF). The concentric rings of the cylindrical detector are replaced by a continuous spiral in the new detector. The spiral geometry detector design leads to a decrease of the detector leakage current. In the spiral detector all electrons generated at the silicon-silicon oxide interface are collected on a guard sink rather than contributing to the detector leakage current. The decrease of the leakage current reduces the parallel noise of the detector. This decrease of the leakage current and the very small capacities of the detector anode with a capacitively matched preamplifier may improve the energy resolution of Spiral Drift Detectors operating at room temperature down to about 50 electrons rms. This resolution is in the range attainable at present only by cooled semiconductor detectors. 5 refs., 10 figs.

13420 **(CEA-N—2564) Study of a transition radiation detector for the DO experiment at FNAL.** Feinstein, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Jun 1988. 130p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88754943/JAW.

The DZero experiment will study proton-antiproton collisions at 1.8 TeV in the center of mass produced at Fermi National Accelerator Laboratory (USA). The main features of the detector are an excellent hermetical calorimeter and a very good identification of muons and electrons. The Transition Radiation Detector contributes to electron/jet discrimination. Transition radiation is emitted when a charge particle crosses the interface between two media of different refraction indices. A N foils radiator produces about N/137 soft X rays when the Lorentz factor gamma of the particle is greater than a threshold of the order of 1000. The radiated energy saturates when gamma goes to infinity. These properties allow to separate electrons from pions until 140 GeV. This study presents the results of a test on a 5 GeV electron and pion beam of a prototype of chamber and of three radiators made of lithium foils, polypropylene foils, and polyethylene fibers. The detector response to pions and electrons is compared to theoretical predictions. Different statistical methods of electron/pion separation are compared on the experimental data. A method has been performed using likelihood functions which obtains a pion rejection greater than 50 for an electron efficiency of 90%. The performances are compared to those of other TRDs.

13421 **(DOE/FTR—9004962) [Progress of the bulk calorimeter for plutonium assay being developed by Imperial College, London, UK, and learn of the latest design of the Laser Surveillance System being developed by the Joint Research Center, Ispra, Italy, March 5--11, 1988]: Foreign trip report.** Fiarman, S. (Brookhaven National Lab., Upton, NY (USA)). 25 Mar 1988. Contract AC02-76CH00016. 30p. NTIS, PC A03 - OSTI. Order Number DE89004962/JAW.

The Imperial College calorimeter is at a late stage of development before final field tests are made and a system shipped to the JRC, Ispra. The LASSY system will be tested in air at Ispra this summer and tested in water by the end of the year, probably in Belgium.

13422 **(DOE/FTR—9005086) [Workshop on pixel detectors, Leuven, Belgium, visit to CERN, Geneva, Switzerland, and International conference on advanced technology and particle physics, Como, Italy, May 26--June 20, 1988]: Foreign trip report.** Kraner, H.W. (Brookhaven National Lab., Upton, NY (USA)). 8 Jul 1988. Contract AC02-76CH00016. 4p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005086/JAW.

The purpose of this trip was: to attend the Workshop on Pixel Detectors as a co-organizer at the IMEC Center for Intergrated Electronics at the Katholick University; to consult and work on the NA(34) HELIOS experiment; and to attend and present paper at the International Conference on Advanced Technology and Particle Physics. Information relating to these objectives is described briefly in this report.

13423 **(DOE/ID/12584—31) Construction and characterization of the RH/RL radium calibration pads.** Steele, W.D.; Marutzky, S.J.; Dickerson, J.W. (UNC Geotech, Grand Junction, CO (USA)). Jan 1989. Contract AC07-86ID12584. 27p. (UNC/GJ—45(TMC)). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006391/JAW.

The US Department of Energy (DOE) Office of Remedial Action and Waste Technology has as one of its goals the standardization of field measurements made by its remedial action contractors throughout the country. In support of this goal, the Technical Measurements Center (TMC) was established at the DOE Grand Junction Projects Office (GJPO) Facility, and was tasked with developing and/or recommending measurement methods for use in support of remedial action programs. One aspect of this technical support is the provision of calibration facilities for standardization of field measurements. The report presents the results of the design, construction, and characterization of 14 calibration pads enriched in

radium-226. The 14 pads comprise 7 sets with a high and low activity pad in each set. The pads are concrete cylinders, approximately 5 feet in diameter by 2 feet in height. They are intended for use in calibrating portable field instruments that are used by remedial action contractors to make direct, in situ measurements of radium-226, thorium-232, and potassium-40. 23 refs., 6 figs., 14 tabs.

13424 **(FNAL/C—88/180-E) Design and performance characteristics of the E769 beamline transition radiation detector.** Errede, D.; Sheaff, M.; Fenker, H.; Lueking, L.; Mantsch, P. (Fermi National Accelerator Lab., Batavia, IL (USA); Wisconsin Univ., Madison (USA). Dept. of Physics). Dec 1988. Contract AC02-76CH03000;AC02-76ER00881. 6p. (CONF-881103—27). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005622/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

A Transition Radiation Detector (TRD) was designed and built for E769, a Fermilab Fixed Target experiment, for use in separating pions form protons or kaons in a 250 GeV/c positive beam at the Tagged Photon Laboratory (TPL). Requirements placed on the detector were that it operate in a high rate (~2 MHz) environment and that it be relatively easy to build since it had to be ready approximately one year from the date of its inception. The short time available precluded exposing prototypes to a test beam making it necessary to rely on source testing and Monte Carlo programs to predict the detector performance. When operated in the beam, the detector performance was in good agreement with these predictions. For a pion detection efficiency of 87%, the contamination by protons of a sample of TRD tagged pions was 2%. 15 refs., 10 figs.

13425 **(FNAL/C—88/185-E) An on-line trigger processor for large transverse energy events.** Zioulas, G.; Arenton, M.; Chen, T.Y.; Conetti, S.; Cox, B.; Delchamps, S.; Etemadi, B.; Fortney, L.; Guffey, K.; Haire, M. (Fermi National Accelerator Lab., Batavia, IL (USA)). Dec 1988. Contract AC02-76CH03000. 6p. (CONF-881103—26). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005624/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

A trigger processor for the selection of events in which photons of large transverse momentum are detected by a lead and scintillating glass calorimeter was designed, constructed, and operated at interaction rates ranging from 2 kHz to 2 MHz. The system achieved suppressions of the raw interaction rate of as much as 1 x 10^{-5}. Raw distributions of tranverse momenta and direct photon event sensitivities are presented from data taken with 300 GeV/c pion and proton beams on a lithium target. 7 refs., 6 figs., 1 tab.

13426 **(GSI—88-61(prepr.)) Response of BaF/sub 2/, CsI(Tl) and Pb-glass detectors to neutrons below 22 MeV.** Matulewicz, T.; Grosse, E.; Emling, H.; Grein, H.; Kulessa, R.; Baumann, F.M.; Domogala, G.; Freiesleben, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Bochum Univ. (Germany, F.R.). Inst. fuer Experimentalphysik). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Bochum Univ. (Germany, F.R.). Inst. fuer Experimentalphysik). Nov 1988. 18p. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

The properties of BaF/sub 2/, CsI(TI) and Pb-glass neutron detection were studied using neutrons of kinetic energies up to 22 MeV produced in deuteron induced reactions on a thick LiF target. The neutron absorption length was extracted from a neutron transmission experiment. The absolute efficiency for neutron detection was determined by comparing neutron energy spectra (obtained from time-of-flight) with that of a calibrated liquid scintillator detector. For BaF/sub 2/ the detection efficiency as function of the threshold on the light-output signal was studied as well as the possibility of pulse-shape discrimination between signals induced by γ-rays and neutrons. It is found that with increasing energies a detection mechanism comes into play which is different from the (n, γ) mechanism predominant at lower energies, and which might allow a (partial) discrimination of γ and neutron induced events at higher neutron energies.

13427 **(INIS-BR—1381) Monitoring of Goiania City, Brazil, using a movable unit.** Moreira, M.C.F. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil)). 1988. 1p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705177/JAW.

13428 (INIS-SU—12, pp 71-74) **Multifunctional amplitude-logic selector.** Il'in, B.A.; Pomogaev, V.V.; Safronov, A.Yu. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

A layout of an amplitude-logic selector designed for application in an energy-mass spectrometer of charged particles in the intermediate energy range is described. The selector is constructed on the basis of the PLM KR 556RT1 big integrated circuit programmed by a user. The sepctrometer detector includes a combination of a time-of-flight system and a semiconductor detector. Secondary electron fluxes, emitted from foils forming the time-of-flight system, are recorded by multichannel plates, which signals come to a time-of-amplitude converter (TAC). Analysed the signal from the outputs of TAC and the semiconductor detector amplifier, one can determine the energy-type composition of a charged particle flux. The selector considered is designed for carrying out such an analysis.

13429 (INIS-SU—12, pp 75-77) **Stable high-ohmic resistance voltage divider.** Gulyj, V.G.; Kamordina, V.M.; Matveev, Yu.V.; Mirskij, I.E. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

Manufacturing methods for a stable high-ohmic resistance voltage divider used as a divider of feedback in the secondary high-voltage power sources for ionizing particle detector are described. The divider is made by the method of thermal evaporation in vacuum to a glass ceramic substrate of resistance alloys RS 1004 and RS 3001. Basic divider parameters are: input resistance - more than 0.5 Ohm; division coefficient - 500; operating voltage up to 3 kV. The methods suggested allow to decrease overall dimensions of the device 2 times and reduce consumption current 3 times.

13430 (INIS-SU—12, pp 41-49) **System of electronic microunits for applications in equipment for physical experiments.** Belov, A.F.; Fedorchenko, S.N. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

Main types of microunits used for amplification and conversion of detector signals in radiometric and spectrometric tracts are considered. Comparative analysis of main features of the microunits produced in the USSR with those of the foreign production is given. the microunit representd a functional unit constructed according to the hybride integral circuit technology. In this case thin film production practice, which permits to reach measuring accuracy up to 0.1%, is used. The main functional aim of the microunits if to provide the integration of measuring tracks of the devices with digital systems of signal recording, accumulation and processing, carried out on the basis of industrial integral circuits. Elements for selection and analog-to-digital conversion are introduced into the microunits. Today the electronic microunit system consists of two series: series 01 includes microunits for detector signal conversion, amplification and shaping, series 02 consists of microunits for signal shaping and measurement of their amplitudes. Functional independence of the microunits, their small sizes allow to increase parameters of the devices designed, to increase functional density of measuring channel arrangement.

13431 (INIS-SU—12, pp 50-57) **Expermental studying the performance of the SRPO-304 X-ray proportional counters.** Vorob'eva, I.V.; Goganov, D.A.; Korolev, V.F.; Lozinskij, B.S.; Sklyankin, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

The results of experimental investigations of the SRPO-304 counter selectivity for X radiation of different energies at the background of charged particles and hard gamma-quanta are analysed. Data for counters with argon-methane, xenon-methane and argon-xenon-methane gas mixtures at different pressures are given. Counters with a complex gaseous mixture are shown to possess the highest selectivity for X radiation in the energy range from 2 to 25 keV when using the method of output pulse discrimination by the rise front.

13432 (INIS-SU—12, pp 58-61) **On the problem about metrological authenticity of results of surface contamination radiometer checking.** Kalashnikov, S.A.; Melkikh, V.G.; Sereda, A.K. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

Problems on metrological authenticity of surface contamination radiometer indications are considered. Effects of calibration device errors on the basis error of the radiometer has been investigated, taking the sources with strontium-90 and yttrium-90 as an example. Analysis of the results obtained has shown that the error, caused by deviation of the source active surface area from the nominal value, and the error, caused by irregularity of activity distribution over the source surface, make basic contributions into the error. Concrete measures to decrease systematic errors when checking radiometers as well as the methods for accounting their effects are suggested.

13433 (INIS-SU—12, pp 62-64) **Some questions of ionizing radiation monitor metrology.** Denisikov, A.I. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

The method of radiation field simulation for calibration and checking of monitors measuring ionizing radiation is suggested. Universal sets of standard beta- and gamma-sources, allowing to carry out calibration and checking of monitors in a wide range of radioactivity levels, are produced. It is advisable to produce specimens for calibration of the devices measuring the low levels of radioactivity at the end of the measuring range, and to check its indication linearity by means of the universal set of sources. In some cases it is recommended to change gamma sources for more safe beta-sources to decrease radiation hazards in the course of monitor calibration.

13434 (INIS-SU—12, pp 107-108) **Porous scintillators for radioactivity absolute measurements.** Denisikov, A.I. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

Applicability of porous scintillators for absolute measurements of solution activity has been investigated. Radioactive nuclides carbon-14 and tritium with softer spectrum of beta-radiation have been investigated. It is shown that the measurement method by means of porous scintillators is simple, cheap, it has high accuracy, allows to use a sample with a big mass and it can be used when solving different problems on radiometry.

13435 (INIS-SU—12, pp 124-126) **Program-controlled generator of delayed pulses for nanosecond time-to-digital converter control.** Dobrov, A.N.; Druzhinin, V.S.; Iovlev, M.V. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

The structure of a delayed pulse generator designed for testing microchannel markers, amplification assemblies, time-to-digital converters, being a part of charged particle time-of-flight spectrometers, is described. The generator is included into a complex of automated test means of spectrometers and it is aimed at interfacing with the ELEKTRONIKA-60 microcomputer channel. The generator circuit is made on the basis of transistor matrices of series 198. The compensation circuit of the accumulation condensator charge permits to stabilize the initial zero potential, that besides high stability of thresholds of discriminating elements 521SA4, permits to obtain accuracy of time interval representation with near 2 ns +- 0.3%.

13436 **(INIS-SU—12) Nuclear instrument making. Scientific-technical collection.** (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). 1987. 135p. (In Russian). NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780052/JAW.

Articles in the collection have been abstracted and indexed separately. DWL

13437 (INIS-SU—68, pp 498) **Liquid organic scintillators for n-γ discrimination.** Afanasiadi, L.M.; Verezubova, S.A.; Kuznichenko, A.V.; Lysova, I.V.; Matyukov, A.V.; Onishchenko, G.M. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13438 (INIS-SU—68, pp 499) **BaF/sub 2/ detector with spectrum converter on base of a liquid scintillator.** Afanasiadi, L.M.; Verezubova, S.A.; Galunov, N.Z.; Kuznichenko, A.V.; Lebedev, V.N.; Lysova, I.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13439 **(ISN—88-22) Subthreshold pion production study with heavy ions at low and medium energy.** Rebreyend, D. (Grenoble-1 Univ., 38 (France)). Feb 1988. 173p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756684/JAW.

In the domain of subthreshold pion production with heavy ions at low and medium energy (40-100 MeV/u), only PI/sup 0/ have been up to now, extensively studied. The incompleteness of the charged pion data and especially the lack of results for pions of energy less than 30 MeV have led to conceive the magnetic spectrometer SPIC. In the present work, we demonstrate that this spectrometer is particularly well suited for the detection of low energy charged pions (Inferior threshold of detection: T/sub PI/ = 7 MeV), emitted around 0/sup 0/ in heavy ion collisions. Principle and performances, successfully tested at 38 and 93 MeV/u, are described in detail. The main characteristics of a PI/sup 0/ spectrometer, that was used to realize a comparative experiment of PI/sup 0/ production, are then given. The last chapter is devoted to experimental results. First, we present the results obtained with the /sup 16/0 beam of 38 MeV/u of the SARA accelerator, in charged pions (Al and Ni targets) and in PI/sup 0/ (Al and Au targets). A comparison of the data PI/sup -//PI/sup 0/ seems to indicate that coulomb effects are surprisingly small. Finally, we report the data obtained with the /sup 16/0 beam of 93 MeV/u of GANIL. In contrast with low energy data, coulomb effects are very strong (ratio PI/sup -//PI/sup +/ = 100 for pions of low energy with heavy targets) and allowed us to extract informations on the geometry of the collision.

13440 **(LA-UR—88-4225) Recent results with the Los Alamos constant-Q spectrometer.** Yethiraj, M.; Robinson, R.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 11p. (CONF-8810182—8). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005472/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

The Constant-Q geometry for measuring excitations on pulsed neutron sources was proposed and tested by Windsor et al. in 1978. By 1985, a second improved Constant-Q spectrometer had been built at Los Alamos and improvements over Windsor's version were listed in a previous ICANS proceedings. In this article, we list further improvements made to the Los Alamos spectrometer and give a brief account of other progress on it. 8 refs., 8 figs.

13441 **(N—89-13240) Holographic particle detection. Semiannual progress report, 1 February-31 July 1988.** Bowen, T. (Arizona Univ., Tucson (USA)). Jul 1988. 15p. (NASA-CR—183315; NAS—1.26:183315). NTIS, PC A03/MF A01.

The feasibility was studied of developing a novel particle track detector based on the detection of 1p-1s emission radiation from electron bubbles in liquid helium. The principles, design, construction, and initial testing of the detection system have been described in previous reports. The main obstacle encountered was the construction of the liquid-helium tight infrared windows. Despite numerous efforts in testing and redesigning the windows, the problem of window leakage at low temperature persisted. Due to limited time and resources, attention was switched to investigating the possibility of using room-temperature liquid as the detection medium. A possible mechanism was the detection of de-excitation radiation emitted from localized electrons in common liquids where electrons exhibit low mobilities, as suggested in the previous report. The purity of the liquid is critical in this method as the dissolved impurities (such as oxygen), even in trace amounts, will act as scavengers of electrons. Another mechanism is discussed whereby the formation of the superoxide ions by electron scavenging behavior of dissolved oxygen is exploited to detect the track of ionizing particles. An experiment to measure the ionization current produced in a liquid by a pulsed X-ray beam in order to study propertiies of the ions is also reported.

13442 **(PITHA—86/08) Monte Carlo simulation of a uranium calorimeter with proportional chamber readout.** Martyn, H.U.; Zhou Jianfeng. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Experimentalphysik 1A und 1. Physikalisches Inst.). 19 Aug 1986. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756518/JAW.

Monte Carlo simulations of a uranium calorimeter with proportional chamber readout using the GHEISHA code are presented and compared with measurements. In particular the influence of different gas mixtures on the relative electron/pion response and the energy resolution is discussed. It is found that the contribution of uranium fission products to the pion signal is only a few percent in gases without hydrogen. By adding hydrocarbons to the gas mixture the pion response may be enhanced only moderately at the expense of the energy resolution.

13443 **(PNL-SA—15890) The response of health physics instruments to temperature variations.** Swinth, K.L.; Hickey, E.E. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 10p. (CONF-881232—12). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005159/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

The response of radiation measuring instruments will vary due to the temperature sensitivity of circuit components and detectors. Tests on approximately 60 dose rate instruments showed significant changes in response to temperature variation ({minus}20 to +50{degree}C). Comparing instrument response at a constant 20{degree}C with responses over the experimental range of temperatures revealed that dose rate responses of some instruments changed over 100%. In tests on a series of instruments of the same model, the change in response varied from instrument to instrument, making it impractical to predict instrument response without tests on the specific instrument. Scintillation detectors, ion chambers, and proportional counters are more sensitive to temperature than are Geiger-Mueller detectors, but stabilization circuits can adequately compensate for the sensitivity of scintillation detectors. Response curves are presented for several instruments over the temperature range of {minus}20 to +50{degree}C. 2 refs., 5 figs., 2 tabs.

13444 **(PNL-SA—15929) The HPS program for accrediting of laboratories for calibration of portable health physics instruments.** Swinth, K.L.; Eisenhower, E.H.; Masse, F.X. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 7p. (CONF-881232—11). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005161/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

The Health Physics Society (HPS) in conjunction with the National Bureau of Standards (NBS) recently established a program for the accreditation of laboratories involved in the calibration of portable health physics instruments. The program goal is to extend to as many field-use instruments as practical, calibration that is consistent with national standards. A two-tier accreditation-level system is established: secondary laboratories which intercompare calibration directly with NBS and tertiary laboratories. The paper describes the background and organization of the HPS program. 5 refs.

13445 **(PNL-SA—16265) Radiation protection instrumentation: A comparison of US and international standards.** Selby, J.M.; Hickey, E.E.; Swinth, K.L. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 6p. (CONF-881232—13). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005158/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

The quality and performance of radiation protection instruments are extremely important in providing conservative protection to radiation workers. The recent American National Standards Institute (ANSI) draft standards on radiation protection instrumentation provide more specific performance requirements and definitive performance tests. International standards for radiation protection instrumentation, published by the International Electrotechnical Commission (IEC), specify general performance, type, and acceptance test requirements. This paper discusses the similarities and differences between the two sets of standards. The results of testing selected instruments against the new draft ANSI standards also are presented. Pacific Northwest Laboratory has tested more than 100 instruments against criteria in draft ANSI N42.17A, which has resulted in changes in the standard. For example, the test for temperature performance was changed to permit more time for equilibration at each test temperature, and the instrument precision requirement was changed from ≦2.5% to ≦10%. 2 refs., 2 tabs.

13446 **(SLAC-PUB—4701-Rev.) Silicon pin diode array hybrids for charged particle detection.** Shapiro, S.L.; Dunwoodie, W.M.; Arens, J.F.; Jernigan, J.G.; Gaalema, S. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1988. Contract AC03-76SF00515. 10p. (CONF-8806257—1-Rev.). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006009/JAW.

From Pixel Detector workshop; Leuven, Belgium (1 Jun 1988).

We report on the design of silicon PIN diode array hybrids for use as charged particle detectors. A brief summary of the need for vertex detectors is presented. Circuitry, block diagrams and device specifications are included. 8 refs., 7 figs., 1 tab.

13447 **(SLAC-PUB—4805) Tracking simulation and wire chamber requirements for the SSC.** Hanson, G.G.; Niczyporuk, B.B.; Palounek, A.P.T. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1988. Contract AC03-76SF00515. 12p. (CONF-8806243—17). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005966/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

Limitations placed on wire chambers by radiation damage and rate requirements in the SSC environment are reviewed. Possible conceptual designs for wire chamber tracking systems which meet these requirements are discussed. Computer simulation studies of tracking in such systems are presented. Simulations of events from interesting physics at the SSC, including hits from minimum bias background events, are examined. Results of some preliminary pattern recognition studies are given. 16 refs., 16 figs., 2 tabs.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

13448 **(AD-A—199693/3/XAB) Method for long-term ionizing-radiation-damage predictions for the space environment. Final report, November 1982-December 1987.** Maier, R.K. (Air Force Weapons Lab., Kirtland AFB, NM (USA)). Aug 1988. 108p. (AFWL-TR—87-136). NTIS, PC A06/MF A01.

The objective of the work is to predict the total dose damage from low-level ionizing-radiation sources for very long (5 years) exposure times. A prior effort to extrapolate annealing data to long times used linear systems theory or the convolution integral. Problems with the linear systems theory approach are: the damage is assumed to be linear even though the experimental data show a saturation effect; the annealing function, which is to be combined with the dose rate, needs to be known for a very long length of time (i.e., a 5-year observation of the annealing); and to do the integral numerically using data requires large amounts of computation.

13449 **(AD-A—200084/2/XAB) Radiation-Hardness-Assured device development. Final report, July 1987-May 1988.** Arimura, I. (Boeing Aerospace Co., Seattle, WA (USA)). Sep 1988. 62p. NTIS, PC A04/MF A01.

Radiation Hardness Assured supplements to four military device detail specification were prepared using radiation characterization data on the six device types included in these specifications. The four RHA specifications (M38510/101, S19500/323, S19500/350, and S19500/355) include provisions for six part types; the 741A, LM101A, LM108A, 2N3251A, 2N3868, and the 2N2920. Group D/E end-points and post-irradiation characteristics are calculated from these data. The methodology for performing these calculations is detailed such that future RHA devices can be developed utilizing this approach.

13450 **(SAND—89-0002C) Overview of radiation hardening for semiconductor detectors.** Dawes, W.R. Jr. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 11p. (CONF-890247—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005606/JAW.

From 5. European symposium on semiconductor detectors: new developments on radiation detectors; Munich, F.R. Germany (21 Feb 1989).

Semiconductor detectors for high energy physics applications offer the potential to obtain accurate particle spacial resolution and on-line data reduction. A significant disadvantage of semiconductor detectors and their associated circuitry however, is their sensitivity to radiation. Fortunately, a sufficient understanding of radiation effects on semiconductor devices exists that some classes of radiation tolerant semiconductor detectors are possible. 11 refs., 11 figs.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 12619, 12833, 12879, 13188, 13226, 13245, 13303, 13304, 13421, 13546, 13919, 14020

13451 **(AD-A—199820/2/XAB) Detectors of infrared radiation based on high-T(c) superconducting YBCO films. Annual report, 1 December 1987-23 February 1988.** Ceballe, T.H. (Stanford Univ., CA (USA). Dept. of Applied Physics). 23 Feb 1988. 87p. NTIS, PC A05/MF A01.

The author achieved control over the orientation and microstructure of the thin films of $YBa_2Cu_3O(7-x)$(YBCO). He elucidated the optical properties of YBCO, including the penetration depth (which turned out to be rather small) and the optical anisotropy (which is rather large). He observed photo-induced signals (i.e. changes in resistivity) of YBCO films in superconducting state as well as in the normal state upon illumination with short pulsed IR radiation generated by the Stanford free-electron laser. Intensive work was continued, and substantial advances made, in the construction of in-situ-growth facilities. Noise measurements were made using films. The noise is found to increase markedly as the quality of the films deteriorates. Raman-effect measurements and ellipsometric measurements give further diagnostic information as to film quality and further understanding of the basic processes going on in the films.

13452 **(BNL—40955) Long trace profile measurements on cylindrical aspheres.** Takacs, P.Z.; Feng, Su-chen Kate; Church, E.L.; Qian, Shi-nan; Liu, Wu-ming. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 11p. (CONF-880887—29). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005661/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

A new long-trace optical profiling instrument is now in operation at Brookhaven National Laboratory measuring surface figure and macro-roughness on large optical components, principally long cylindrical mirrors for use in synchrotron radiation beam lines. The non-contact measurement technique is based upon a pencil-beam interferometer system. The optical head is mounted on a linear air bearing slide and has a free travel range of nearly one meter. We are able to sample surface spatial periods between 1 mm (the laser beam diameter) and 1 m. The input slope data is converted to surface height by a Fourier filtering technique which distributes the random noise error contributions evenly over the entire trace length. A number of optical components have been measured with the instrument. Results are presented for fused silica cylinders 900 mm and 600 mm in length and for a fused silica toroid and several electroless nickel-plated paraboloids. 9 refs., 8 figs.

13453 **(EGG-M—88152) VAXGAP: A code for the routine analysis of gamma-ray pulse-height spectra on a VAX computer.** Killian, E.W.; Hartwell, J.K. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 5p. (CONF-881103—25). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005418/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

VAXGAP (VAX Gamma-ray Analysis Package) is a collection of computer programs for the analysis of pulse height spectra acquired on Ge detector-based spectrometers. VAXGAP was written to provide the operators of a radiation measurements laboratory with the necessary software tools for routine analysis of radioactive samples through the analysis of gamma-ray pulse-height spectra. A detailed description of the algorithms used in VAXGAP is presented elsewhere. This paper summarizes the unique features and the organization of VAXGAP which makes it of particular value in the routine analysis of spectra. 1 ref., 3 figs., 1 tab.

13454 **(EGG-M—88159) An ultrasonic pulser/receiver system with extended dynamic range and low distortion.** Beller, L.S.; Johnson, L.C.; Taylor, S.C. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 6p. (CONF-880760—9). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005406/JAW.

From Review of progress in quantitative nondestructive evaluation; La Jolla, CA, USA (31 Jul 1988).

The increasing sophistication of quantitative ultrasonic techniques and signal processing requires signal electronics systems having performance characteristics which are significantly better than those of conventional designs. Better performance, in terms of extended signal dynamic range, stability, bandwidth, and signal distortion, is becoming essential for many applications in the laboratory and in the field; further, software control of large automated systems often requires specialized circuit configurations, which are not available. This paper addresses the design of an ultrasonic signal system which has proven very useful as the major signal-conditioning component in obtaining improved performance in large, automated ultrasonic systems. Extended dynamic range comes from improvements in the signal/noise ratio (SNR). Both terms in the ratio are addressed, increased sensitivity through pulser design, and noise primarily in receiver design and careful attention to circuit details. The system is entirely modular and includes provisions for software-driven gain control and random multiplexing of many channels. The key, and most difficult, elements in the system are the pulser and amplifier. The major part of the discussion will be on these elements and the rationale for their design, rather than on circuit details. Use of these elements in large automated systems and in laboratory investigations will also be discussed. 6 refs., 2 figs.

13455 **(EGG-M—88487) Simultaneous in-flight measurement of particle size, velocity and temperature.** Fincke, J.R.; Jeffery, C.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 7p. (CONF-881026—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005411/JAW.

From National thermal spray conference; Cincinnati, OH, USA (24 Oct 1988).

A measurement techniques for simultaneously obtaining the size, velocity and temperature of particles entrained in high temperature flow fields is described. Particle size and velocity are obtained from a dual color combination laser Doppler velocimeter (LDV) and laser particle sizing system. The LDV system consists of a crossed beam technique while particle size is determined from the absolute magnitude of scattered laser light. The particle temperature is determined by a two-color pyrometer technique. The spatial resolution is better than 1 mm^3 and allows the distribution of particle size, velocity and temperature to be mapped over laboratory scale flow fields. Typical data are presented. 14 refs., 8 figs.

13456 (INIS-SU—12, pp 109-112) **Logging measuring computerized complex for nuclear-physical studies in survey wells.** Berstenev, G.V.; Grinshtejn, Yu.A.; Eremeev, V.A. and others. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

Problems of logging measuring computerized complex constructions to carry out nuclear-physical investigations for survey wells are considered. Properties of complex units providing main problems of logging of the wells are given.

13457 **(LA-UR—88-4131) Recent advances in high speed photography and associated technologies in the USA.** Paisley, D.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-8808103—5). NTIS, PC A03/MF A01 - OSTI; GPO Dep. Order Number DE89005460/JAW.

From 18. international congress on high-speed photography and photonics; Xian, China (28 Aug 1988).

In the past decade, high speed photography has been rapidly incorporating electro-optics. More recently, optoelectronics and digital recording of images for specialized laboratory cameras and commerically available systems have helped broaden the versatility and applications of high speed photography and photonics. This paper will highlight some of these technologies and specialized systems. 10 refs., 22 figs.

13458 **(N—89-12405) Net current measurements and secondary electron emission characteristics of the Voyager plasma science experiment and their impact on data interpretation.** Mcnutt, R.L. Jr. (Massachusetts Inst. of Tech., Cambridge (USA)). Sep 1988. 195p. (NASA-CR—181351; NAS—1.26:181351; CSR-TR—88-6). NTIS, PC A09/MF A01.

The Voyager Plasma Science (PLS) instrument is capable of returning integral (DC) current measurements, similar in some respects to measurements made with a Langmuir probe or a retarding potential analyzer, although there are significant differences. The integral measurements were made during a calibration sequence in the solar wind, during Cruise Science Maneuvers, and within the magnetospheres of Jupiter and Saturn by Voyager 1. After the failure of the PLS experiment following the Saturn encounter, that instrument was placed in the DC return mode returning possibly usable data from early 1981 through early 1985. The DC return measurements are difficult to interpret and are above threshold values only for relatively large fluxes; the determination of the measured current level is dependent on the operating temperature of the preamplifiers which further complicates the interpretation. Nevertheless, these measurements can be used to determine the efficiency of the suppressor grid at preventing the loss of secondary electrons off the collector plate. Some DC return measurements have been invaluable in aiding in the interpretation of some electron plasma measurements not previously understood. It is found that electron spectra can be significantly modified by the presence of second generation secondary electrons produced by either first generation secondaries or photoelectrons on the support ring of the negative high voltage modulator grid within the instrument housing.

13459 **(SAND—88-1935) Telemetry system modulation calculator.** Robinett, R.D. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1988. Contract AC04-76DP00789. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006004/JAW.

A PC-compatible computer program has been written as an aid for the rf telemetry designer to implement modulation schemes in the system design process. It is applicable to frequency modulated transmission systems. The program handles modulation composites composed of pulse code modulation and subcarrier oscillators, separately, or in hybrid combinations. The program calculates composite signal modulation parameters, custom fits that to a recommended system bandwidth, and returns a quality descriptor. 4 refs.

13460 **(UCID—21605) Workshop on models to estimate military system probability of effect (P/sub E/) due to incident radiofrequency energy: Volume I, Findings and recommendations.** Cabayan, H.S. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006074/JAW.

The workshop on Models to Estimate Military System P/sub E/ (probability of effect) due to Incident Radio Frequency (RF) Energy was convened by Dr. John M. MacCallum, OUSDA (R and AT/EST), to assess the current state of the art and to evaluate the adequacy of ongoing effects assessment efforts to estimate P/sub E/. Approximately fifty people from government, industry, and academia attended the meeting. Specifically, the workshop addressed the following: current status of operations research models for assessing probability of effect (P/sub E/) for red and blue mission analyses; the main overall approaches for evaluating P/sub E/'s; sources of uncertainty and ways P/sub E/'s could be credibly derived from the existing data base; and the adequacy of the present framework of a national HPM assessment methodology for evaluation of P/sub E/'s credibility for future systems. Military operations research (MOR) analyses need to support current and future high power RF device development and operational employment evaluations. USDA (R and AT/EST) sponsored this workshop in an effort to assess MOR's current capability and its maturity. Participants included service, OSD, national laboratory, con-

tractor, and academic experts and practitioners in this emerging technology area. Following is a summary of major findings and recommendations. 1 tab.

13461 **(UCID—21608) Calculations of time to sync for rotating mirror cameras.** McMillan, C. (Lawrence Livermore National Lab., CA (USA)). 16 Dec 1988. Contract W-7405-ENG-48. 2p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006073/JAW.

In order to avoid spinning the rotors on the rotating mirror cameras at Site 300 any more than necessary, a formula has been developed that tells the average time to get synchronization for an arbitrary number of cameras. A Symphony spread sheet is available which will do the calculation. 1 ref.

13462 **(UCRL—53894) Increasing the camera capacity and dynamic range of a Pinex module.** Schumacher, F.; Adams, C.; Doman, M. (Lawrence Livermore National Lab., CA (USA)). Dec 1988. Contract W-7405-ENG-48. 10p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006314/JAW.

We have increased by one-half the camera capacity of a Pinex (pinhole-imaging neutron experiment) module originally designed for eight cameras, so that it now contains 12 cameras. The redesigned camera module has been tested and successfully fielded in an underground nuclear test. The key to adding four more cameras was the use of beam splitters in the lines of sight of four of the existing cameras. Half the light going to each of these four existing cameras was thus redirected to one of the new cameras; in this way, the new cameras could be mounted in the module so as not to crowd the eight existing cameras. Full alignment capabilities (tilt and rotation) are maintained for all 12 cameras. This modification to the original design is simple and relatively inexpensive to make, and it increases the sensitivity range and data-acquiring capacity of the camera module by 50%. 4 refs., 7 figs.

13463 **(UCRL—97727) Interferometer for wave front measurements of laser pulses.** Bliss, E.S.; Goodman, M.J.; Holloway, F.W. (Lawrence Livermore National Lab., CA (USA)). Apr 1988. Contract W-7405-ENG-48. 7p. (CONF-880402—10). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005652/JAW.

From CLEO '88: OSA/IEEE conference on lasers and electro-optics; Anaheim, CA, USA (25 Apr 1988).

A self-referencing polarization interferometer is combined with simultaneous four phase video detection to provide an instrument for rapid and accurate measurement of pulsed laser wave fronts. 3 refs., 2 figs.

13464 **(UJV—8307-T,V) Vibration feeder of powered materials.** Cermak, V.; Markvart, M. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Apr 1988. 14p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705313/JAW.

The design and function test of two models of a new vibration feeder of powdered materials are described. Powder particles in a storage bin discharging hole are stirred with a vibrating cone and allowed to fall down around the cone perimeter. The dosing rate can be controlled by the cone lift, by the amplitude of the vibrations and by the flow rate of an inert gas around the cone. The results of dosing U/sub 3/O/sub 8/ and zinc powders are presented and discussed. (author). 10 figs., 1 tab., 8 refs.

13465 **(WINCO—1048) Automated low energy photon counting spectrometer using a robotic sample changer.** Lewis, A.L.; Delmastro, J.R.; Wade, M.A. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls (USA)). Aug 1988. Contract AC07-84ID12435. 42p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005972/JAW.

To increase sample throughput and decrease analyst time requirements, a totally automated low energy photon counting spectrometry system was developed. A Perkin-Elmer robot is used as an automatic sample changer for up to five low energy photon spectrometry (LEPS) detectors operated with a Nuclear Data ND6700 system. The entire system, including the robot, is controlled by an IBM PC-AT using software written in compiled BASIC. The IBM is interfaced to the Digital Equipment Corporation LSI 11/2 computer that runs the ND6700 system and also to a Data General MV8000 LIMS computer. The design features incorporated to meet the requirements of our radiochemical analysis group and our quality control program are discussed. Problems associated with the development of the system and modifications to the robot are discussed. 2 figs., 1 tab.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 13903

45 EXPLOSIONS AND EXPLOSIVES

13466 **(UCRL—53872-Rev.1) Optical magnification correction in dynamic size measurements from refraction at conical shock fronts.** Goosman, D.R. (Lawrence Livermore National Lab., CA (USA)). 19 Oct 1988. Contract W-7405-ENG-48. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004973/JAW.

An analytical formula is derived for the magnification error in optical size measurements of objects inside conically shaped shock fronts. End detonation of a cylindrically shaped explosive immersed in a fluid necessitates a correction due to refraction at the interface between the shocked and unshocked fluids. It is shown that for detonations immersed in a liquid such as water, the correction factor derived for a conical shock front is significantly larger than the simple correction factor derived if the shock front is assumed to be cylindrical. 2 refs., 5 figs.

4501 Chemical

REFER ALSO TO CITATION(S) 12994, 13283, 13309

13467 **(LA—11451) Chemical warfare arms control: Issues and challenges: Report No. 6.** Apt, K.E. (Los Alamos National Lab., NM (USA)). Nov 1988. Contract W-7405-ENG-36. 32p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005940/JAW.

This report considers the major issues concerning chemical weapons and their prohibition. It discusses the US policy on chemical warfare and analyzes the chemical weapons treaty and its verification regime currently under negotiation at the Geneva Conference on Disarmament. Also presented are discussions of the nature of the chemical warfare threat and the limitations of earlier international agreements. The report includes an explanation of chemical agents and a chronology of events relevant to chemical warfare. 24 refs., 1 tab.

4502 Nuclear

REFER ALSO TO CITATION(S) 13309, 13462, 14115

13468 **(AD-A—199654/5/XAB) Algorithm for calculating the area of overlap of an ellipse and a convex polygon. Research paper, October-November 1987.** Helmbold, R.L. (Army Concepts Analysis Agency, Bethesda, MD (USA)). Nov 1987. 62p. (CAA-RP—87-4). NTIS, PC A04/MF A01.

This paper describes a new and improved algorithm for estimating in computer simulations the area of overlap of an ellipse and a convex polygon. The need for such algorithms arises frequently in military operations analysis, in particular in estimating the portion of a rectangular target overlapped by a disk-shaped nuclear coverage area. A detailed description of the algorithm and illustrations of its application are included.

13469 **(AD-A—199736/0/XAB) Nuclear Weapons Development Guidance CY1987 program review. Technical report, 15 June-24 December 1987.** Yap, M.W. (Science Applications International Corp., McLean, VA (USA)). 24 Dec 1987. 25p. NTIS, PC A03/MF A01.

The purpose of this effort was to evaluate the Nuclear Weapon Development Guidance (NWDG) process. The effort identified deficiencies in the process and researched solutions to correct those deficiencies. Based on the research, options/courses of action were nominated. The effort recommended proposed revisions to the NWDG program. Overall, the program assessment reflects a growing consensus that the NWDG serves a useful purpose. However, sharp differences in opinion continue to exist on how to proceed. The bottom line remains; codify NWDG, strengthen TAT (Technical Assistance Teams) precursor visits, establish reverse TATs and strengthen the long range planning focus.

13470 **(AD-A—199796/4/XAB) Defense Science Board Task Force on the review of the Defense Nuclear Agency technology base program. Final report.** (Defense Science Board, Washington, DC (USA)). Apr 1982. 73p. NTIS, PC A04/MF A01.

The purpose of this Defense Science Board Task Force review was to examine DNA's responsiveness to DoD needs and the appropriateness of its emphasis on emerging technologies, and to evaluate the relationships between DNA and Dept. of Energy laboratories, private consultants, university participants and Service users. The Task Force also addressed important technical and management issues confronting DNA. The Task Force concluded that DNA has been responsive to DoD needs, although the technology base program has a few specific areas of weakness. The Task Force expressed support of recent DNA initiatives to assign greater priority to the survivability of Theater Nuclear Forces and their associated C3. Also emphasized were the importance of underground nuclear explosion testing and the need for a review of several questions left unanswered by the ban on atmospheric testing. Principal Task Force recommendations include: 1) Resources provided to the DNA technology base longer-term programs should not be diverted into more-pressing short-term projects; 2) Relationships between DNA and other DoD and DoE laboratories should be strengthened by exchange programs of technical personnel; and 3) Technology transfer between DNA and the Services and the CINCs should be improved by annual reviews of user requirements and joint funding of projects where appropriate.

13471 **(AD-A—200017/2/XAB) Analysis of near-source contributions to early P-wave coda for underground explosions. 1. Wave form complexity.** Thorne, L.; Welc, J.L. (Michigan Univ., Ann Arbor (USA). Dept. of Geological Sciences). Jun 1987. 25p. NTIS, PC A03/MF A01.

Pub. in Bulletin of the Seismological Society of America, Vol. 77, No. 3, 1017-1040(Jun 1987).

A data set of more than 1600 teleseismic short-period P waves from 46 nuclear explosions is analyzed to establish near-source contributions to the first 15 sec of the P signals. The near-source components are isolated by event-to-event comparisons of first-cycle magnitudes, RMS amplitudes in the first 5 and next 10 sec of the wave forms, and energy temporal centroid measurements. Events from the Nevada, Amchitka, and Novaya Zemlya test sites are analyzed separately to characterize overall source-region variations. Event-averaged waveform complexity variations between explosions within a given site are tested for dependence on source strength, burial depth, location within the site, and tectonic release. Azimuthal patterns of the individual event complexity anomalies are used to discriminate between possible near-source influences. For events at Pahute Mesa, a strong azimuthal amplitude pattern in both the direct P waves and the P coda for all of the events is produced principally by deep mantle variations. Defocusing by a high-velocity anomaly in the crust and uppermost mantle beneath the site has a stronger effect on the direct P signals than on the early P coda, resulting in a systematic, spatially varying relative pattern.

13472 **(AD-A—200062/8/XAB) Nuclear winter and nuclear policy: implications for US and Soviet deterrence strategies. Master's thesis.** Griffin, G.A. (Naval Postgraduate School, Monterey, CA (USA)). Sep 1987. 126p. NTIS, PC A07/MF A01.

Nuclear weapons were rapidly incorporated into the policies for maintaining the national security objectives of both the Soviet Union and the United States--in spite of poorly understood nuclear-weapons effects. The nuclear winter hypothesis, the basis of which was first proposed in 1982, directed scientific research into the consequences of massive amounts of dust and smoke, from nuclear detonations, on the earth's climate and subsequently on the ecology of the earth. This thesis presents the evolution of the nuclear winter hypothesis in order to elucidate its unique aspects for global devastation and the consensus of plausibility which the hypothesis holds in the scientific community. The hypothesis has aroused a flurry of debate on its implications for nuclear policy. With the historical aspects of the nuclear era as a backdrop, the question of incorporating new scientific information on the consequences of nuclear war into policy is discussed. The observed responses of the U.S. and Soviet Union and the implications for future actions in response to the nuclear winter hypothesis are examined-- leading to the conclusion that the hypothesis will have little or no impact on U.S. and Soviet nuclear policy.

13473 **(LA—11405) Achieving mutual deterrence with active defenses: Report No. 4.** Kupperman, R.H.; Selden, R.W.; Smith, H.A. (Los Alamos National Lab., NM (USA)). Aug 1988. Contract W-7405-ENG-36. 45p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005939/JAW.

In this report, a model of mutual deterrence by fixed, land-based missile forces is discussed. In the model, both parties maintain boost-phase and preferential terminal defenses. Computations are given for different system configurations, and conclusions are presented about the cost-effective maintenance of mutual deterrence. 5 refs., 4 figs.

13474 **(UCRL—98468-Rev.1) PACER revisited.** Moir, R.W. (Lawrence Livermore National Lab., CA (USA)). 18 Nov 1988. Contract W-7405-ENG-48. 6p. (CONF-881031—22-Rev.1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004878/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

This paper discusses a modified version of the PACER concept for power and nuclear material production. In the PACER concept, a 20-kt peaceful nuclear explosion is contained in a cavity about 200 m in diameter, filled with 200 atom of 500{degree}C steam. Energy from the explosion is used to produce power, and the neutrons are used to produce materials such as ^{233}U. The present idea is to modify the PACER concept in three ways to improve the practicality, predictability, and safety of power production from this technology and thus improve public acceptance of this power source. These improvements are (1) line the cavity with steel; (2) replace the steam with molten salt, LiF + BeF_2; and (3) reduce the explosive yield to about 2 kt. PACER is the only fusion power concept where the underlying technology of the power source itself is proven and in hand today. The molten-salt shock-suppression and heat transport system and the durability of the underground cavity need demonstration. 10 refs., 3 figs., 1 tab.

4503 Explosion Detection

13475 **(UCRL—21139) Analysis of data recorded in eastern Kazakh: Final report.** Priestley, K.F.; Walter, W.R. (Lawrence Livermore National Lab., CA (USA)). Dec 1988. Contract W-7405-ENG-48. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006052/JAW.

The objectives of this research are to better understand both the velocity and attenuation structure of the crust and upper mantle of eastern Kazakh, and the character of the explosion source from regional and teleseismic data. Initial emphasis has been on analysis of teleseismic data. Comparison of results from eastern Kazakh with similar results for Nevada should improve our understanding of the differences observed between US and Soviet nuclear explosions. 12 refs., 5 figs., 2 tabs.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 13238, 13741

13476 **(AD-A—200333/3/XAB) Urban-climate effects of energy demand for space heating.** Sheaffer, J.; Reiter, E. (Colorado State Univ., Fort Collins (USA). Engineering Research Center). 1988. 15p. NTIS, PC A03/MF A01.

Pub. in Meteorology and Atmospheric Physics, Vol. 38, 202-214(1988).

In the course of studying the weather dependence of fuel requirments for space heating in buildings, extensive and detailed heat-source data were developed for several urban areas. These data were subsequently used for validating urban temperature fields derived from an advective-thermodynamic model of urban mixing heights. Results include analyses of urban climate data for assessing model performance under varying weather conditions and for validation of model assumptions. Empirical function for estimating stability and mixing heights in adjacent rural areas were also developed.

13477 **(DOE/PC/79668—T1) Conceptual design of a coal-fired MHD retrofit plant: Quarterly report for April 1988--June 1988.** Van Bibber, L.E.; Wiseman, D.A.; Holman, R.R.; Bernard, F.E. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.). Nov 1988. Contract AC22-87PC79668. 25p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004151/JAW.

The objective of the project is to prepare a site-specific conceptual design of a coal-fired magnetohydrodynamic (MHD) system for retrofit to the Scholz Generating Station, Sneads, Florida. The MHD System includes a topping cycle and bottoming cycle but no integrated seed regeneration system. Provisions for future integration of a seed regeneration system will be made with respect to location at the utility site, waste heat utilization, and materials handling. The conceptual design shall include: process, system, and equipment descriptions, interface identification and requirements, equipment and handling arrangements, an overall plant layout, cost and schedule for the design, fabrication/procurement, and arrangement of each major component, and a critical path for the total system effort. The conceptual design will be in sufficient detail to ensure that the integration of the MHD System with the Scholz Generating Station will be compatible with the utility industry standards for constructability, operability, reliability, and maintainability. 6 figs., 1 tab.

13478 **(GSF-BPT—6/88) Chemistry and physics of fog-water collection. Final report.** Jaeschke, W.; Enderle, K.H. (eds.). (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung). 1988. 159p. (CONF-8612173—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756521/JAW.

From Workshop on fog chemistry; Frankfurt am Main, F.R. Germany (16 Dec 1986).

Increasing interest in the problems of air pollution and source receptor relationships has led to a significant expansion of knowledge in the field of atmospheric chemistry. In recent years the multiphase atmospheric chemistry was given great scholarly attention, and slogans like acid precipitation, dirty cloud or killer fog indicated these phenomena. The report describes results of collection and chemical analysis of fog water with emphasis or fog microphysics, of the heterogeneous atmospheric chemistry project in the Po-valley, of the development of the Great Dun Fell project, of the mountain cloud chemistry project in eastern U.S., of the design of fog water collectors and of the numerical study of the radiation fog event on October 10/11, 1982 in Albany, N.Y.

13479 **(GWI—5564) Determination of diffusion characteristics of various gaseous emissions, with different release conditions.** Hoitz, J.; Knauber, R.; Kremer, H. (Gaswaerme-Institut e.V., Essen (Germany, F.R.)). 23 Jun 1981. 92p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756398/JAW.

In a wind tunnel a ground-close wind profile was simulated and diffusion measurements were effected by means of concentration measurements of tracer gases. The large number of the possible building configurations and wind blowing conditions were reduced to three basic configurations: wind was blown against a U-shaped building complex vertically and in the angle from the convex side and vertically from the concave side. Parameters were the form of gas release and the position (height) of the emission source. A calculation program was developed that is able to calculate relatively simple processes of diffusion with consideration to obstacles.

13480 **(KFK-PEF—44) Analysis of the TULLA measurements (TULLA data bank).** Franck, J.; Fiedler, F. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftre; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Meteorologie und Klimaforschung; Karlsruhe Univ. (T.H.) (Germany, F.R.). Meteorologisches Inst.). Sep 1988. 112p. (In German). NTIS (US Sales Only), PC A06. Order Number DE88756401/JAW.

The following report describes the work of the data centre and the organization of the data bank to the field experiment named 'TULLA'. The objective of the experiments were to gather the measuring data and to store it in an arranged magnetic tape format called 'GATE-FORMAT 3' (GF3) in order to make it quickly and effective available for data requirements. This report contains no detail representations of measuring data, but it gives informations how and where you can find special data sets. A short introduction about the building up and the characterization of the applied data format modified in some items (named GF3.T) facilitate the data reading.

13481 **(UCRL—99718) Three dimensional and stereo graphics: Some meteorological examples.** Grotch, S.L. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 29p. (CONF-8810268—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004019/JAW.

From Joint conference of the United States/Department of Energy and People's Republic of China; Beijing, China (8 Oct 1988).

The primary purpose of the enclosed material is to provide a number of examples using real meteorological data to illustrate the potential for displaying and analyzing data using three dimensional graphics and displaying and analyzing data using three dimensional graphics and stereoscopic projections ("stereo"). As may be seen in these few examples, there is a wide range of "enhancements" possible with three dimensional graphics which can be used to produce an extraordinarily rich set of images for the scientist. It is hoped that these examples may inspire others to explore these techniques and to see for themselves how valuable such visualization can be in practical problems. In the United States, the technology for generating and displaying three dimensional graphics is changing explosively. As recently as a year ago, generating such images on a small computer was impossible. Since that time, simple variants of these plots have become possible on MacIntosh-like computers. There can be little doubt that this technology will continue to rapidly improve, making it possible for a much wider group of scientists to exploit these techniques. 2 refs., 10 figs.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 12730, 13027, 13076, 13280, 13363, 13478, 13626, 13667, 13668, 13673

13482 (AD-A—199794/9/XAB) Microcomputer pollution model for civilian airports and Air Force Bases. Model application and background. Segal, H.M. (Federal Aviation Administration, Washington, DC (USA). Office of Environment and Energy). Aug 1988. 94p. (FAA-EE—88-5). NTIS, PC A05/MF A01.

This is one of three reports describing the Emissions and Dispersion Modeling System (EDMS). All reports use the same main title--A MICROCOMPUTER MODEL FOR CIVILIAN AIRPORTS AND AIR FORCE BASES--but different subtitles. The subtitles are: (1) USER'S GUIDE - ISSUE 2 (FAA-EE-88-3/ ESL-TR-88-54); (2) MODEL DESCRIPTION (FAA-EE-88-4/ ESL-TR-88-53); (S) MODEL APPLICATION AND BACKGROUND (FAA-EE-88-5/ESL-TR-88-55). The first and second reports above describe the EDMS model and provide instructions for its use. This is the third report. IT consists of an accumulation of five key documents describing the development and use of the EDMS model. This report is prepared in accordance with discussions with the EPA and requirements outlined in the March 27, 1980 Federal Register for submitting air-quality models to the EPA. Contents: Model Development and Use - Its Chronology and Reports; Monitoring Concorde EMissions; The Influence of Aircraft Operations on Air Quality at Airports; Simplex A - A simplified Atmospheric Dispersion Model for Airport Use -(User's Guide); Microcomputer Graphics in Atmospheric Dispersion Modeling; Pollution from Motor Vehicles and Aircraft at Stapleton International Airport (Abbreviated Report).

13483 (AD-A—199795/6/XAB) Microcomputer pollution model for civilian airports and Air Force bases. User's guide - Issue 2. Segal, H.M. (Federal Aviation Administration, Washington, DC (USA). Office of Environment and Energy). Aug 1988. 46p. (FAA-EE—88-6). NTIS, PC A03/ MF A01.

Over the past 8 years, the Federal Aviation Administration (FAA) and the United States Air Force (USAF) have developed a number of user-friendly emissions and dispersion models for air-quality assessment purposes. The major result of this effort is the Emissions and Dispersion Modeling System (EDMS) which was completed in 1985 and released to the general public. Since that time, major modifications have been made in the EDMS system to enhance its usability and incorporate an integral dispersion model into its code. The approach of this guide is to provide hands-on instructions on how to use the model. The mechanism for doing this is an example problem introduced early in this document. Four short sections precede the example problem instructions. The first shows how the EDMS evolved from the earlier FAA and USAF mainframe models. The next three sections describe the hardware and software required to run Section 5 provides the hands-on instructions to produce: 1) an emissions inventory of all sources at an airport/airbase; and 2) an estimate of the concentrations produced by these sources at four airport locations. An inexperienced user should be able to process the example problem in less than 3 hours.

13484 (AD-A—200025/5/XAB) Propellent & chemical spill and dispersion model. Raj, P.K.; Morris, J.A.; Kunkel, B.A. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 22 Sep 1988. 13p. (AFGL-TR—88-0235). NTIS, PC A03/MF A01.

The defense services transport, store, and use many kinds of chemicals including fuels, oxidizers, propellants, and weapons-related chemicals. Many of these chemicals are volatile and may form dense vapor clouds if they are released into the atmosphere. Depending on the physical properties of the chemical, storage conditions, release conditions and weather conditions different types of vapor clouds may be formed (heavy clouds, aerosol-bearing clouds, instantaneous puffs, continuous plumes, etc.). In addition, some of the chemicals may react with ambient moisture. It has been shown in the literature that the behavior of heavy vapor clouds is considerably different from that of neutral density vapor clouds.

13485 (AD-A—200026/3/XAB) Review and current status of the USAF Toxic Chemical Dispersion Model (AFTOX). Kunkel, B.A. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 27 May 1988. 11p. (AFGL-TR—88-0236). NTIS, PC A03/MF A01.

The Air Force is in the process of replacing its 25-year-old Ocean Breeze/Dry Gulch dispersion model with a more state-of-the-art dispersion model. The replacement model is a Gaussian puff/plume model designed to run on the Zenith-100 microcomputer. It will handle continuous or instantaneous, liquid or gas, elevated or surface release from a point or area source. The model contains an additional option for continuous heated plumes from stacks. The model will 1) produce screen or printer plots of concentration contours, 2) compute concentration at specified point and time, and 3) compute maximum concentration at given elevation and time. The model has many unique features including the computation of a continuous stability parameter, the inclusion of the concentration averaging time and surface roughness, the ability to print now or save/print later, the ability to correct input data without restarting, easy access to chemical data file for adding, deleting, and correcting data, and a plot of the plume and 90% hazard area with automatic scaling. An IBM compatible version of the model has also been written. The model has been evaluated using data from over 200 dispersion tests. The model and user's manual have been completed and turned over to the Air Weather Service for final validation.

13486 (AD-A—200121/2/XAB) Source characterization of heavy-gas dispersion models for reactive chemicals. Volume 1. Final report, 22 January 1986-21 December 1987. Raj, P.K.; Morris, J.A. (Technology and Management Systems, Inc., Burlington, MA (USA)). 21 Dec 1987. 258p. NTIS, PC A12/MF A01.

See also volume 2, AD-A192 209.

U.S. Air Force and other agencies that handle, store, and transport chemicals, fuels, and oxidizers are interested in determining the potential area of hazard posed by the dispersion of vapors generated by accidental spills. This report describes the mathematical models developed to described a variety of source types and the dispersion of vapor clouds/plumes in the atmosphere. Sixteen different source types are modeled including pressurized-liquid releases, flashing and aerosol formation, two-phase jet releases, explosive releases, and releases of high-vapor pressure liquids, cryogenic liquids, and gases. The dispersion model takes into account the differences in source characteristics, higher-than-air density of clouds (due to aerosol presence, temperature or molecular weight). Reactions of the chemicals, if any, ..the water vapor in the air are modeled and considered in the dispersion model. Transition from heavy-gas dispersion to near-neutral density dispersion is modeled without abrupt changes in size or discontinuity in concentrations.

13487 (ASRC-SUNY-Pub—1276) Atmospheric Sciences Research Center (ASRC) report, 1986--1987. Blanchard, D.C. (ed.). (State Univ. of New York, Albany (USA). Atmospheric Sciences Research Center). Jul 1988. 102p. The Atmospheric Sciences Research Center, State University of New York, 100 Fuller Road, Albany, NY 12205. Order Number TI89005955/JAW.

Research at the Center has spanned from studies on the fundamental understanding of electrical discharges in the atmosphere and the mechanisms for the production of aerosols from the oceans to the development of detailed theoretical models of the transport, chemical transformation and removal of chemical constituents in the atmosphere. We have measured the fluxes of trace gases within the rain forests of the Amazon, and determined the chemical composition of the ambient air and liquid cloud water at 4820 feet on the top of Whiteface Mountain. In all our activities we adhere to a fundamental responsibility which is part of the Center's charter, that is, to promote and encourage programs of research in the basic and applied sciences.

13488 **(BNL—41952) Control of global cloud albedo and climate by marine dimethylsulfide emissions: A test by anthropogenic sulfur dioxide emissions.** Schwartz, S.E. (Brookhaven National Lab., Upton, NY (USA)). Oct 1988. Contract AC02-76CH00016. 5p. (CONF-890134—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004534/JAW.

From Symposium on the role of clouds in atmospheric chemistry and global climate; Anaheim, CA, USA (29 Jan 1989).

This paper examines the hypothesized link between gaseous precursors of aerosol sulfate and global albedo and mean temperature. The thesis of this discussion is that since marine DMS emissions are substantially lower than present emissions of other gaseous precursors of atmospheric sulfate, principally SO_2 associated with fossil fuel combustion, globally, and especially in the Northern Hemisphere, then consequently, if as CLAW suggest marine DMS emissions exert a major influence on global mean albedo and temperature, such an influence should also result from anthropogenic SO_2 emissions. The potential for such anthropogenic influence on cloud albedo and global mean temperature has been noted. However, CLAW explicitly "ignore the perturbations of the atmospheric sulphur cycle by manmade fluxes of SO_2 {hor←ellipsis} and {hor←ellipsis} consider only the natural fluxes, which currently represent about 50% of the total flux of gaseous sulphur to the atmosphere, and which still dominate the atmospheric sulphur cycle in the Southern Hemisphere". It is argued here that the increase in SO_2 emissions over the past 100 years and the difference in gaseous sulfur emissions between the Northern Hemisphere (NH) and Southern Hemisphere (SH) constitute a global experiment that tests the hypothesis that planetary albedo and mean temperature are regulated by marine DMS emissions. Comparison of present NH and SH cloud component of planetary albedo and of 100-year temperature records yields no indication of any influence of anthropogenic SO_2 emissions qualitatively or quantitatively consistent with expectation based on the CLAW hypothesis applied to these emissions. 24 refs., 5 figs.

13489 **(CONF-880912—24) Chemistry of organic carbon in soil with relationship to the global carbon cycle.** Post, W.M. III. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 24p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005128/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

Various ecosystem disturbances alter the balances between production of organic matter and its decomposition and therefore change the amount of carbon in soil. The most severe perturbation is conversion of natural vegetation to cultivated crops. Conversion of natural vegetation to cultivated crops results in a lowered input of slowly decomposing material which causes a reduction in overall carbon levels. Disruption of soil matrix structure by cultivation leads to lowered physical protection of organic matter resulting in an increased net mineralization rate of soil carbon. Climate change is another perturbation that affects the amount and composition of plant production, litter inputs, and decomposition regimes but does not affect soil structure directly. Nevertheless, large changes in soil carbon storage are probable with anticipated CO_2 induced climate change, particularly in northern latitudes where anticipated climate change will be greatest (MacCracken and Luther 1985) and large amounts of soil organic matter are found. It is impossible, given the current state of knowledge of soil organic matter processes and transformations to develop detailed process models of soil carbon dynamics. Largely phenomenological models appear to be developing into predictive tools for understanding the role of soil organic matter in the global carbon cycle. In particular, these models will be useful in quantifying soil carbon changes due to human land-use and to anticipated global climate and vegetation changes. 47 refs., 7 figs., 2 tabs.

13490 **(CONF-880912—25) Biogeochemistry of CO_2 exchange between terrestrial ecosystems and the atmosphere.** Dale, V.H.; Houghton, R.A. (Oak Ridge National Lab., TN (USA)). 28 Oct 1988. Contract AC05-84OR21400. 36p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005122/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

Changes in the amount of carbon stored in terrestrial ecosystems are, in part, responsible for the increase in atmospheric CO_2levels. The most important changes due to shifts in global forest biomass as a result of land clearing or other changes in land use. The pattern of land-use change and its effects on carbon release from terrestrial ecosystems have varied over time. Carbon releases from terrestrial ecosystems which result from land-use changes are difficult to quantify accurately because of uncertainties in (1) rates of land clearing and abandonment, (2) estimates of the carbon stored in biomass of managed and unmanaged ecosystems, and (3) rates of change in carbon storage following conversion from one land use to another. Furthermore, a feedback loop exists between atmospheric CO_2 levels and forests because elevated CO_2 and its accompanying climate change are likely to alter global forest growth and, consequently, carbon storage in terrestrial ecosystems. 48 refs., 7 figs., 1 tab.

13491 **(CONF-8809168—4) Second US-USSR symposium on air pollution effects on vegetation.** Reichle, D.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004925/JAW.

From 2. US-USSR symposium on air pollution effects on vegetation; Gatlinburg, TN, USA (21 Sep 1988).

The topics of discussion focus on international environmental issues and recognize the need to protect natural resources; identify the global nature of environmental pollution; appreciate the importance of developing bioindicators; to anticipate global change; and understand the importance of projected natural areas for long-term monitoring and research. This is also an extremely appropriate location for this symposium, since the Southern Appalachian Biosphere Reserve is a model of natural area protection, monitoring, and experimental research sites{endash}as well as interinstitutional cooperation among all of the major, environmental institutions in the region.

13492 **(DOE/CE/30838—T1) Results of the combustion and emissions research project at the VICON incinerator facility in Pittsfield, Massachusetts: Draft final report: Volume 1, Text.** (Midwest Research Inst., Kansas City, MO (USA)). 18 Feb 1987. Contract FG01-85CE30838. 212p. NTIS, PC A10/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003430/JAW.

Airborne emissions of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) can be produced as a result of incomplete combustion of municipal solid waste (MSW). However, knowledge is limited about the incinerator design and operating conditions which cause these compounds to be formed or which can be adjusted to minimize or eliminate their discharge. In addition, the chemical forms of chlorine and precursors which may contribute to the formation of PCDD and PCDF are not clearly known. This study focuses on determining the relationships between incinerator combustion/operating variables, refuse characteristics, and emission levels of PCDD and PCDF, as well as selected potential precursor compounds.

13493 **(DOE/ER/60494—T1) Absolute Sea Level Pilot Regional Networks Project: Progress report: Draft.** Carter, W.E.; Diamante, J.M.; Scherer, W. (National Oceanic and Atmospheric Administration, Washington, DC (USA)). Jan 1988. Contract AI01-86ER60494. 113p. NTIS, PC A06 - OSTI. Order Number DE89005261/JAW.

One of the generally acknowledged key indices of climate change is sea level, and long-term trends in global sea level are critical factors in understanding long-term changes in climate. The importance of global sea level observations and research was recently underscored by the US WOCE Science Steering Committee. Large-scale melting of polar ice and thermal expansion of ocean water due to any global warming trend is expected to be reflected eventually in sea level data. However, whether the reported rise in observed global sea level can be properly related to a postulated global warming trend, perhaps due to observed increases in atmospheric carbon dioxide and trace gases cannot be rigorously answered at the present time. One major problem is in the quality and nature of the existing sea levels measurements networks. These are inadequate in terms of extracting certain systematic biases from

long-term sea level trends. Most significant of these biases is the vertical motion of the coastal land areas to which the sea level measurements are referenced. However, the technical basis for removing this error source now exists in the form of the modern geodetic positioning systems.

13494 **(EPRI-EA—6150) Exposure to acidic sulfates in the atmosphere: Review and assessment: Final report.** Lipfert, F.W. (Electric Power Research Inst., Palo Alto, CA (USA); Lipfert (F.W.), Northport, NY (USA)). Dec 1988. 148p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005538/JAW.

This report presents a critical review of published studies on the acidity of atmospheric sulfate aerosols, with emphasis on methods of measurement and their errors and shortcomings. The report augments published estimates of aerosol acidity with those based on particulate sulfate, nitrate, and ammonium concentrations obtained from the data bases compiled for the Sulfate Regional Experiment (SURE), Eastern Regional Air Quality Study (ERAQS), and the New York Summer Aerosol Study (NYSAS). In general, the level of aerosol acidity will depend on the method of measurement. All of the methods examined have shortcomings, especially those which use collection of samples on filters without discriminating by particle size. In the SURE/ERAQS data which were examined, aerosol acidity was estimated indirectly by means of ion balance ("apparent acidity"). Long-term average (periods of a month or more) levels of aerosol acidity were in the range of 1–7 $\mu g/m^3$ as H_2SO_4 (20–140 $nmol/m^3$ H^+), with the higher values occurring in the regions of highest SO_2 emission density and near the Great Lakes. The highest short-term concentrations were mostly in the range 10–40 $\mu g/m^3$, for averaging times from 1–24 hours. Urban values tended to be somewhat lower than rural values. Sulfate alone was not a reliable predictor of acidity levels; in general, only a small portion of the variance in acidity could be predicted by the concentrations of precursor air pollutants, including SO_2 and ozone. 130 refs., 30 figs., 16 tabs.

13495 **(Juel—2217) Coupling of a chemiluminescence detector with a gas chromatograph for selective measurement of oxidized nitrogen compounds in the atmosphere.** Flocke, F.; Volz, A.; Kley, D. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie 2 - Chemie der Belasteten Atmosphaere). Jul 1988. 83p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756522/JAW.

This report describes the development of a specific and sensitive analytical technique for the measurement of organic nitrates. Separation of the different species is achieved by capillary gaschromatography. Chemiluminescence (NO/O/sub 3/) in combination with catalytic conversion (Au/CO at 300/sup 0/C) are used for detection. This combination converts individual NO/sub y/ species including organic nitrates to NO, which is then detected by its chemiluminescence upon reaction with O/sub 3/. For atmospheric samples with low concentrations of organic nitrates, cryogenic preconcentration from about 3 l of air is employed. The different components of the analytical system were tested in the laboratory. The detection limit was found to be on the order of a few ppt in a 3 l sample. Separation of the nitrates by chain length was best achieved on an unpolar stationary phase (OV-1, 10 m wide-bore capillary). Reproducibility, including cryogenic sampling, was found to be +-5%. Explorative measurements at Juelich confirmed the existence of organic nitrates in ambient air.

13496 **(N—89-13111) Backscatter laser depolarization studies of simulated stratospheric aerosols: crystallized sulfuric acid droplets. Final report, 2 June 1986-1 June 1988.** Sassen, K.; Zhao, H.; Yu, B.K. (Utah Univ., Salt Lake City (USA)). Nov 1988. 20p. (NASA-CR—183387; NAS—1.26:183387). NTIS, PC A03/MF A01.

The optical depolarizing properties of simulated stratospheric aerosols were studied in laboratory laser (0.633 micrometer) backscattering experiments for application to polarization lidar observations. Clouds composed of sulfuric acid solution droplets, some treated with ammonia gas, were observed during evaporation. The results indicate that the formation of minute ammonium sulfate particles from the evaporation of acid droplets produces linear depolarization ratios of beta equivalent to 0.02, but beta equivalent to 0.10 to 0.15 are generated from aged acid cloud aerosols and acid droplet crystallization effects following the introduction of ammonia gas into the chamber. It is concluded that partially crystallized sulfuric acid droplets are a likely candidate for explaining the lidar beta equivalent to 0.10 values that have been observed in the lower stratosphere in the absence of the relatively strong backscattering from homogeneous sulfuric acid droplet (beta equivalent to 0) or ice crystal (beta equivalent to 0.5) clouds.

13497 **(NIPER—354) Off temperature ambient FTP [Federal Test Procedure] (Tasks 1 and 2): Final report.** Allsup, J.R. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Jul 1988. Contract FC22-83FE60149. 49p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004077/JAW.

Twenty-four late model fuel-injected vehicles were tested for exhaust emissions and fuel economy at temperatures of 20{degree}, 50{degree}, and 75{degree} F using a commercial fuel of 11.8 lbs. RVP. The vehicles were tested using the FTP and a cold and hot-start, low-speed short test cycle. The data will be used in EPA's air quality model to estimate emissions at varied temperatures and varied driving cycles.

13498 **(NP—9770230) TEMES annual report 1986. Results from continuous measurements by the telemetric emission measuring network TEMES in North-Rhine Westphalia.** Pfeffer, H.U.; Kuelske, S.; Beier, R. (Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany, F.R.)). 1988. 174p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE89770230/JAW.

The report provides closed coverage of the state of air quality in the Rhine-Ruhr area as well as in forested sections of North-Rhine Westphalia on the basis of the results from continuous measurements. Presented are the results received for the pollutants sulfur dioxide (SO/sub 2/), nitric oxide (NO), nitrogen dioxide (NO/sub 2/), carbon monoxide (CO), suspended particulates and ozone (O/sub 3/). In addition, the meteorological investigations are covered with regard to the parameters wind direction, wind velocity, air temperature, relative humidity, precipitation and radiation budget. The discussion of the pollution level includes observations on the influences excerted by the wind direction and on the temporal development of the atmospheric pollutant concentrations. In 1986 no exceeding of TA Luft air quality standards was observed.

13499 **(NYSERDA—87-16-Vol.2) Results of the combustion and emissions research project at the Vicon Incinerator Facility in Pittsfield, Massachusetts: Volume 2, Appendices A-G: Final report.** (New York State Energy Research and Development Authority, New York (USA); Midwest Research Inst., Kansas City, MO (USA)). Jun 1987. Contract FG01-85CE30838. 359p. NTIS, PC A16/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005630/JAW.

Atmospheric emissions of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) can be generated as a result of combustion of municipal solid waste (MSW). However, knowledge is limited about the incinerator design and operating conditions that cause these compounds to form and that can be adjusted to minimize or eliminate their discharge. This study focused on identifying the relationships between incinerator operating conditions, waste characteristics, combustion variables, and levels of PCDDs and PCDFs and selected other semivolatile organic compounds measured in the combustion gases. The study was designed primarily to evaluate the effect of the following parameters on levels of PCDDs/PCDFs in the combustion gases: Incinerator operating conditions; PVC content of the waste; Moisture content of the waste; and Combustion gas variables. Further, the study investigated the relationship between levels of PCDDs/PCDFs and other semivolatile organic compounds measured in the combustion gases.

13500 **(NYSERDA—87-16-Vol.3) Results of the combustion and emissions research project at the Vicon Incinerator Facility in Pittsfield, Massachusetts: Volume 3, Appendices H-K: Final report.** (New York State Energy Research and Development Authority, New York (USA); Midwest Research Inst., Kansas City, MO (USA)). Jun 1987. Contract FG01-85CE30838. 249p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005631/JAW.

Atmospheric emissions of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) can be generated as a result of combustion of municipal solid waste (MSW). However, knowledge is limited about the incinerator design and operating conditions that cause these compounds to form and that can be adjusted to minimize or eliminate their discharge. This study focused on identifying the relationships between incinerator operating conditions, waste characteristics, combustion variables, and levels of PCDDs and PCDFs and selected other semivolatile organic compounds measured in the combustion gases. The study was designed primarily to evaluate the effect of the following parameters on levels of PCDDs/PCDFs in the combustion gases:Incinerator operating conditions; PVC content of the waste; Moisture content of the waste; and Combustion gas variables. Further, the study investigated the relationship between levels of PCDDs/PCDFs and other semivolatile organic compounds measured in the combustion gases.

13501 **(ORNL/CDIAC—28) Environmental consequences of CO_2-climate interactions: The need for integrated resource analysis.** Cushman, R.M.; Waterhouse, J.C.; Farrell, M.P. (Oak Ridge National Lab., TN (USA)). Jan 1989. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005707/JAW.

The increasing concentration of atmospheric carbon dioxide is expected to alter the global climate, and thereby affect agriculture, forestry, fisheries, and water resources. Resources such as these interact on a regional scale, and realistic projections of the effects on these resources must take into account the important interactions and feedbacks linking them. In addition, carbon dioxide directly affects the water use and growth of vegetation; therefore, the interactive effects of carbon dioxide and climate must also be considered. These interactions and feedbacks pose a significant challenge to any attempt to model the response of resources to changing carbon dioxide and climate. In particular, model linkage and the integration of processes that operate on different spatial and temporal scales are problems that must be addressed. 19 refs., 5 figs.

13502 **(PB—89-118343/XAB) Incinerating the pesticide ethylene dibromide (edb): a field-scale trial-burn evaluation of environmental performance.** Oberacker, D.A.; Roeck, D.R.; Brzezinski, R. (Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab.). Oct 1988. 15p. (EPA—600/D-88/198). NTIS, PC A03/MF A01.

The paper is an overview of the trial burn of a representative quantity of waste EDB pesticides and is based upon results presented in the Final Report prepared for Rollins by Alliance Technologies Corporation. The results demonstrated that the brominated material could be safely incinerated with no significant bromine stack emissions. Recent experience by industry with brominated wastes strongly suggested that the major objection to incinerating EDB, the uncontrolled release of bromine (Br) to the atmosphere, could be overcome by the addition of sulfur to the combustion process. One of the major objectives of the trial burn was to verify that the present of sulfur as SO_2 would force the conversion reaction of Br to hydrogen bromide(HBr).

13503 **(PB—89-118392/XAB) Achieving a transmission-electron-microscopy clearance criterion at asbestos abatement sites in ew Jersey.** Brownlee, J.A.; Lucas, J.H.; Walls, K.J.; Murphy, J.J.; DiNardo, C. (Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab.). Oct 1988. 16p. (EPA—600/D-88/227). NTIS, PC A03/MF A01.

Representatives of the New Jersey Department of Health's Asbestos Control Service conducted final clearance evaluations at 79 schools where asbestos removal took place during the Summer of 1987. The evaluations entailed a thorough visual inspection of each abatement area by an experienced inspector, the performance of aggressive air sampling, and sample analysis by transmission electron microscopy (Yamate-revised Method). Each abatement site was evaluated against an absolute air-clearance criterion of 0.01 fiber per cubic centimeter (f/cu cm). The results of the study support the premise that a thorough visual inspection strongly influences passing a transmission electron microscopy (TEM) clearance test. These data also demonstrate that post-abatement air concentrations that meet the clearance criterion (0.01 f/cu cm) can be achieved by a detailed cleaning, thorough visual inspection, and subsequent use of aggressive air-sampling techniques.

13504 **(PB—89-118400/XAB) Particulate and organic emissions from unvented kerosene heaters: test house study.** Jackson, M.D.; Rasor, S.A.; Clayton, R.K.; Stephenson, E.E. (Acurex Corp., Research Triangle Park, NC (USA)). 1988. 12p. NTIS, PC A03/MF A01.

This paper discusses a study of particulate and organic emissions from unvented kerosene heaters in a test house. Results from the test house are compared with those from large (room size) chambers, using EPA's indoor-air-quality (IAQ) model. In the test house, unvented kerosene-heater particulate emissions were collected on Teflon-coated glass-fiber filters. Organic emissions were trapped on Tenax-GC and XAD-2 sorbents, and the organic compounds were identified by gas chromatography/mass spectrometry. Target compounds were then quantified. CO, CO_2, and SO_2 were monitored during each test. Weather data were also collected for correlation with emissions and house-characterization data. The test house is a typical three-bedroom, two-bath, single-story frame house with crawl space. It has natural-gas heat and electric central air conditioning. The house is 8 years old and has the energy-efficiency features of homes built during the early 1980s.

13505 **(PB—89-124408/XAB) Rocky Mountain acid-deposition model assessment: Acid Rain Mmountain Mesoscale Model (ARM3). Final report.** Morris, R.E.; Kessler, R.C.; Douglas, S.G.; Styles, K.R.; Moore, G.E. (Systems Applications, Inc., San Rafael, CA (USA)). Nov 1988. 318p. NTIS, PC A14/MF A01.

See also PB—87-180584.

The Acid Rain Mountain Mesoscale Model (ARM3) is a mesoscale acid-deposition/air-quality model developed for calculating incremental acid-deposition (sulfur and nitrogen species) and pollutant-concentration impacts in complex terrain. The model was set up for operation within the Rocky Mountain region. The model contains many simplications that were necessary to meet operational requirements. New research studies to provide information on mesoscale flow over complex terrain and atmospheric chemistry in the western region would be necessary to help resolve questions concerning the validity of the model simplifications. The ARM3 consists of six components. Of them, the mesoscale meteorological model contains a new diagnostic wind model that accounts for the kinematic, deflection, and thermal effects that alter the flow fields due to complex terrain. The Lagrangian acid-deposition/air-quality model has the following attributes: two options for calculating plume height above ground; three options for determining dispersion rates, including one that accounts for terrain roughness; a dry deposition algorithm based on the resistance approach; a wet-deposition algorithm based on the scavenging approach; and two options for calculating chemical transformation.

13506 **(PB—89-124457/XAB) Stationary-source characterization and control strategies for reactive volatile organic compounds.** Martin, G.B. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). Nov 1988. 9p. (EPA—600/D-88/235). NTIS, PC A02/MF A01.

This paper provides a brief overview of the sources of volatile organic compounds (VOCs) and of the control technologies that may be used to control these emissions. VOCs are emitted to the atmosphere from a variety of processes. These compounds may react in the lower atmosphere as part of the process leading to ozone generation and/or may be classified as hazardous air pollutants (HAPs) which have direct health impacts.

13507 **(PB—89-124614/XAB) Validation data for photochemical mechanisms: experimental results. Interim report, April 1986-December 1987.** Sexton, K.G.; Arnold, J.R.; Jeffries, H.E.; Kale, T.L.; Kamens, R.M. (North Carolina Univ., Chapel Hill (USA). Dept. of Environmental Sciences and Engineering). Nov 1988. 85p. NTIS, PC A05/MF A01.

See also PB—87-145298.

The smog-chamber facility of the University of North Carolina (UNC) was used to provide experimental data for the EPA and atmospheric model developers for testing and validating kinetic mechanisms of photochemical smog formation. In the study, 71 dual experiments were performed using NOx and various hydrocarbons and hydrocarbon mixtures. Experiments were also conducted to better understand and characterize (1) the chamber when operated dynamically to simulate continuous emissions and dilution, and (2) the solar radiation inside the smog chamber. The chamber experiments described in the report were added to the existing UNC data base for model testing, bringing the total number of dual experiments in the data base to 417. The data base is available on an ANSI-formatted magnetic tape.

13508 **(PB—89-124622/XAB) Control Technology Center current status and future plans. Final report, December 1986-September 1988.** Nolen, S.L. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). Oct 1988. 37p. (EPA—600/9-88/022). NTIS, PC A03/MF A01.

This report gives the current status of and future plans for EPA's Control Technology Center (CTC). Initially established to help reduce public exposure to toxic air pollutants in the ambient air, the CTC's program has been expanded to also include emission source and control technology assessments associated with air toxics, particulate matter, oxides of sulfur and nitrogen, and volatile organic compounds (VOCs), as well as emission measurements.

13509 **(PB—89-126601/XAB) Climate change and its interactions with air chemistry: perspectives and research needs. Interim report.** Penner, J.E.; Connell, P.S.; Wuebbles, D.J.; Covey, C.C. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. 96p. NTIS, PC A05/MF A01.

This report attempts to outline and estimate the interactions between climate change and atmospheric chemistry that need investigation on both local and/or regional and global scales. The problem is enormously complex and is not simply one of estimating temperature change and running chemical models already in use. The changing climate influences many different factors such as precipitation, atmospheric transport, changes in budgets of species with biological sources, changes in UV light because of stratospheric ozone depletion, changes in deposition rates, etc. The single most significant finding in the study is that very little is known about the interactions of the above cited effects with either climate or air pollution. Current analyses suggest that it is improbable that present trends towards increasing concentrations will be arrested or reversed in the near future.

13510 **(PB—89-126726/XAB) Precision and accuracy assessments for state and local air-monitoring networks, 1981-1986.** Rhodes, R.C. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Monitoring Systems Lab.). Aug 1988. 372p. (EPA—600/4-88/037). NTIS, PC A16/MF A01.

See also PB—88-180138.

Precision and accuracy assessments of air-quality data obtained from State and local air monitoring agencies during the six years, 1981-1986, are summarized in graphical form for each reporting organization. For most reporting organizations, the graphs show an improvement in data quality during the six-year period. Comparisons across reporting organizations for the same pollutant measurements reveal persistent significant differences. The data-quality assessments are also summarized and shown graphically for each EPA Region and for the Nation. The report covers the period from 1981 through 1986.

13511 **(PB—89-127468/XAB) Description of the Process Model Projection Technique (PROMPT). Version 3.0. Final report, October 1985-March 1986.** Hogan, T. (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Oct 1988. 44p. NTIS, PC A03/MF A01.

The report describes the model logic and data sources for Version 3.0 of the Process Model Projection Technique (PROMPT), one of four stationary source emission and control cost-forecasting models developed for the National Acid Precipitation Assessment Program (NAPAP). PROMPT projects air pollution emissions (SO_2, sulfates, and NOx) and costs for industrial combustion and industrial processes (e.g., process heaters, furnaces, dryers, kilns, engines, turbines, and wood-fired boilers). PROMPT excludes emissions from the combustion of natural gas, distillate and residual fuel oil, and coal in industrial boilers. The outputs are provided for 1980 (baseline), 1985 (forecasted, not actual), 1990, 1995, 2000, 2010, 2020, and 2030. The data sources used to develop PROMPT Version 3.0 predate the release of the final 1980 NAPAP Emissions Inventory.

13512 **(PB—89-127492/XAB) Guideline for design, installation, operation, and quality assurance for dry-deposition monitoring networks.** Porter, L.F. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Research and Development). Sep 1988. 357p. (EPA—600/3-88/047). NTIS, PC A16/MF A01.

This manual provides basic, practical, field-tested guidance on the installation, operation, maintenance, calibration, and auditing of dry-deposition measurement systems. The information provided is based primarily on EPA's experience in installing, operating, maintaining, and auditing the National Dry Deposition Network. It has been supplemented with information gathered from personnel involved in other acid deposition and some non-acid deposition monitoring networks, and by a review of present research and development efforts. Each section of the manual first describes the activities covered by the topic area, then it describes the quality-control activities.

13513 **(PB—89-127518/XAB) Analytical techniques for measuring the effects of acid deposition on coatings on wood.** Balik, C.M.; Fornes, R.E.; Gilbert, R.D. (North Carolina State Univ., Raleigh (USA)). Nov 1988. 60p. NTIS, PC A04/MF A01.

Preliminary experiments were carried out to characterize the potential deleterious effects of acidic deposition on three representative paints: an oil alkyd paint and two acrylic latex formulations. The base-polymer latex common to both latex paints was also studied individually. Free films of paint were exposed to relatively high levels of gaseous SO_2 and ultraviolet light, and were immersed in aqueous SO_2 at pH 2.0. Several analytical techniques were used to assess the resulting chemical and physical changes in the paint films, including sorption and diffusion measurements, attenuated total-reflectance infrared spectroscopy, dynamic mechanical analysis, sol-gel analysis, contact-angle measurements, differential scanning calorimetry, and electron spin resonance. All techniques show promise for characterizing the early stages of damage to paint films caused by acidic deposition. The major effects noted include leaching of acid-soluble extender components upon immersion in aqueous SO_2, and enhanced degradation of the base polymer upon exposure to gaseous SO_2, and ultraviolet light.

13514 **(PB—89-127591/XAB) Hybrid Single-Particle Lagrangian Integrated Trajectories (HY-SPLIT): model description. Technical memo.** Draxler, R.R. (National Oceanic and Atmospheric Administration, Silver Spring, MD (USA). Air Resources Lab.). Sep 1988. 29p. (NOAA-TM-ERL-ARL—166). NTIS, PC A03/MF A01.

The algorithms and equations used in the development of a long-range transport and dispersion model are presented. The model calculation methods are a hybrid between Eulerian and Lagrangian approaches. A single-pollutant particle represents the initial source. Advection and diffusion calculations are made in a Lagrangian framework. However, meteorological input data can either be gridded from rawinsonde observations or archived from the output of a Eulerian primitive equation forecast model. As the

dimensions of the initial particle diffuse into regions of different wind direction or speed, the single particle is divided into multiple particles to provide a better representation of the more-complex flow field. Air concentrations are calculated on a fixed three-dimensional grid by integrating all particle masses over the sampling time.

13515 (PB—89-130108/XAB) Health-hazard evaluation report HETA 88-122-1912, Computer Products Corporation, Boulder, Colorado. Lee, S.A. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Jul 1988. 12p. (HETA—88-122-1912). NTIS, PC A03/MF A01.

In response to a request from the management of Computer Products Corporation, Boulder, Colorado, an investigation was made of solvent exposures, after workers had complained of headaches and nausea. About 12 workers were employed at the site assembling circuit boards. Small components were cleaned manually by workers using cotton swabs wetted with isopropyl-alcohol. One additional worker cleaned whole circuit boards in an open pan of the solvent for about 1 hour. Three other workers nearby in the potting department use cotton swabs wetted with acetone or 1,1,1-trichloroethane. An 18-gallon tank of Humiseal Acrylic Coating containing mostly toluene and xylene was also present for circuitboard cleaning. Breathing-zone air samples were collected from seven workers to evaluate solvent exposures. Solvent-mixture exposures for six workers ranged from 7 to 15% of the combined evaluation criteria; one worker was exposed to 66% of the combined evaluation criteria. The author concludes that there were no exposures to solvents in excess of the recommended limits at the time of the visit. The author recommends that local-exhaust ventilation be used during some of the procedures and that protective gloves be worn to reduce skin exposure to the sensitizers.

13516 (PB—89-130116/XAB) Health-hazard evaluation report MHETA 88-103-1915, Pittsburgh Energy Technology Center, Bruceton, Pennsylvania. Ferguson, R.P. (National Inst. for Occupational Safety and Health, Morgantown, WV (USA). Div. of Respiratory Disease Studies). Jun 1988. 15p. (MHETA—88-103-1915). NTIS, PC A03/MF A01.

In response to a request from the Pittsburgh Energy Technology Center, Bruceton, Pennsylvania, a site visit was made to investigate possible hazardous working conditions resulting from the presence of an odor in the atmosphere. The odors were coming from the vicinity of the women's restroom in building 900A. Air samples were collected for some toxic gases and vapors. Carbon dioxide increased from 415 parts per million in the morning to 1000 parts per million in the afternoon, indicating that there was very little fresh air being introduced into the building through the air-handling system. Two soil samples from underneath the building were also taken and revealed a cycloocta form of elemental sulfur, extremely low levels of aliphatic hydrocarbons, and a few phthalate esters. The author concludes that soluble forms of sulfur may have leached out of the soil during rainy or wet periods and oxidized to produce an odor. The author recommends that water should be redirected away from building 900A, that all foundation vents to this building be open for cross ventilation and that all leaking plumbing fixtures be fixed. Better ventilation should be provided by installing an air-handling system at one end of the affected building to supply fresh air and an exhaust system at the other end of the building to assist air flow.

13517 (PB—89-130124/XAB) Health-hazard evaluation report HETA 87-431-1916, Bolles Opera House, West Chicago, Illinois. Reh, C.M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Jul 1988. 20p. (HETA—87-431-1916). NTIS, PC A03/MF A01.

An evaluation was made of the extent of mercury contamination at the Bolles Opera House, West Chicago, Illinois, which was being used for conversion of hard copies into microfilm and microfiche. The previous owner of the building had used the facility as a sales office and laboratory for producing thorium. During renovations, inorganic mercury spilled onto the floor when drain traps and drain pipes on the second floor broke open. Attempts were made to clean the spill, but some mercury remained in cracks in the wooden floors. Spill areas were then covered with either carpet or linoleum. Fourteen rooms or areas in the building had detectable mercury levels, mostly under the recommended exposure limits of 50 micrograms/cubic meter (microg/m^3). One reading in the basement where the mercury-contaminated plumbing was stored was 82 microg/m^3. Urine samples collected from 12 workers showed levels below the limit of detection of 4 micrograms per gram of creatinine. The author concludes that a health hazard did not exist from mercury exposure at the time of the evaluation; the contaminated pipes be removed and disposed of properly; the basement be cleaned correctly, and that the city of West Chicago be notified that the previous owner disposed of unknown amounts of mercury via the city's sewer system.

13518 (PB—89-130132/XAB) Health-hazard evaluation report HETA 87-309-1906, Louisiana-Pacific Corporation, Missoula, Montana. Lee, S.A. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Jun 1988. 16p. (HETA—87-309-1906). NTIS, PC A03/MF A01.

An investigation was made of possible hazardous working conditions at the Louisiana-Pacific Corporation, Missoula, Montana. Upper respiratory irritation, headaches, and dizziness had been reported by workers in the particle-board painting department. Eight workers operated the automated painting process. Full-shift time-weighted average exposures to solvent mixtures ranged from 26 to 110% of the combined evaluation criteria for individual solvents. Toluene, methyl ethyl ketone, and methyl isobutyl ketone were the major solvent components. Air formaldehyde concentrations ranged from 0.1 to 0.3mg/m^3. The printer operator was exposed to 50mg/m^3 of butyl cellosolve. The author concludes that a potential hazard from overexposure to organic solvent mixtures existed as well as overexposure to formaldehyde. The author recommends that the ventilation system in the painting department be checked and upgraded to ensure that it is able to provide the recommended capture velocity at the paint rollers, that additional ventilation methods be installed where needed, that butyl cellosolve be replaced, and that a medical surveillance program be established.

13519 (PB—89-130140/XAB) Health-hazard evaluation report HETA 86-441-1913, Monark Boat Company, Monticello, Arkansas. Roper, P. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Jul 1988. 25p. (HETA—86-441-1913). NTIS, PC A03/MF A01.

An investigation was made of health problems at the MonArk Boat Company, Monticello, Arkansas. MonArk manufactured aluminum and fiberglass boats. About 200 hourly production workers were employed at the site. Fiberglass-reinforced plastic-resin hulls were sprayed with a gel coat consisting of vinyl ester or polyester resins containing free styrene monomer and methyl ethyl ketone peroxide catalyst. Average exposures during the work shift to styrene vapor did not exceed recommended limits, but there were short-term exposures of 114 to 250 parts per million (ppm). Exposures to 13 micrograms/cubic meter (microg/m^3) of chromates and 160 ppm of toluene exceeded recommended limits in the spray painting area of the aluminum fishing boat facility. Exposures to methylene bisphenyl isocyanate(MBI) at 0.21 to 0.57mg/m^3 exceeded the OSHA limit of 0.2mg/m^3. Methylene-bis(4-cyclohexylisocyanate) was found at 0.7 to 3.1mg/m^3. An organotin concentration of 0.38mg/m3 was found during a 49-minute period. The author concludes that health hazards exist from exposures to styrene, chromates, toluene, isocyanates, and possibly organotin. The author recommends that efforts be made to improve use of personal protective equipment, educate the employees to the dangers, improve ventilation practices, and institute a medical surveillance program.

13520 (PB—89-130157/XAB) Health-hazard evaluation report HETA 86-284-1914, H. B. Smith Company, Inc., Westfield, Massachusetts. McManus, K.P.; Bicknell, R.J.; Klincewicz, S. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Jul 1988. 25p. (HETA—86-284-1914). NTIS, PC A03/MF A01.

In response to a request from Local 95, Molders and Allied Workers Union, an evaluation was made of exposures to chemicals at the H.B. Smith Company, Inc., Westfield, Massachusetts, due to concern over symptoms of breathing difficulties experienced by workers. Workers at the foundry were involved in coremaking, mold making, casting, shake out, and knockout operations. Possible exposures to carbon monoxide (CO), respirable free silica, dimethylethylamine(DMEA), and acrolein were determined. Acrolein was not detected. CO levels ranged from 0.3 to 95 parts per million (ppm), and DMEA was found at 0.9 to 10.4mg/m³. The respirable free silica ranged up to 0.54mg/m³. Pulmonary function tests and x rays showed no evidence of silicotic lung disease. The authors conclude that a health hazard existed due to worker exposures to respirable free silica, DMEA, and CO. The authors recommend measures to reduce worker exposures, including a mandatory personal protective-equipment policy, administrative and engineering controls for CO, improvements in ventilation, and periodic medical examinations.

13521 **(PB—89-852677/XAB) Asbestos: industrial applications and precautions. January 1974-November 1988 (Citations from Information Services in Mechanical Engineering data base). Report for January 1974-November 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 71p. NTIS PC N01/MF N01.

Supersedes PB—87-862165.

This bibliography contains citations concerning the impacts that federal regulations have had on the use of asbestos in industrial environments. The advantages and disadvantages of the application of industrial robots in areas of high concentrations of asbestos dust, the use of water as a cutting tool to control the generation of asbestos dust, asbestos-substitute materials in industrial applications, and governmental policies and attitudes relative to health and welfare of workers subjected to asbestos are among the topics discussed. Thermal insulation properties, wear characteristics, high-temperature capabilities, and asbestos reinforcement in composite materials are included. (This updated bibliography contains 165 citations, 10 of which are new entries to the previous edition.)

13522 **(PB—89-852693/XAB) Asbestos and silicate pollution (excluding workplace pollution). January 1970-February 1987 (Citations from the NTIS data base). Report for January 1970-February 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 188p. NTIS PC N01/MF N01.

See also PB—89-852701.

This bibliography contains citations concerning the occurance and effects of asbestos and silicate pollution outside of the workplace. Topics include increased cancer risk associated with asbestos pollution, and the hazards of silica-dust inhalation and silicate effects on water resources. Included are pollutant sources, and sampling techniques and test results of analyses of indoor air samples, drinking water, and ground water for these pollutants. Asbestos and silicate pollution in the workplace and asbestos-removal technology are considered in other bibliographies. (This updated bibliography contains 378 citations, none of which are new entries to the previous edition.)

13523 **(PB—89-852701/XAB) Asbestos and silicate pollution (excluding workplace pollution). March 1987-December 1988 (Citations from the NTIS data base). Report for March 1987-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 53p. NTIS PC N01/MF N01.

Supersedes PB—87-855326. See also PB—89-852693.

This bibliography contains citations concerning the occurance and effects of asbestos and silicate pollution outside of the workplace. Topics include increased cancer risk associated with asbestos pollution, and the hazards of silica-dust inhalation and silicate effects on water resources. Included are pollutant sources, and sampling techniques and test results of analyses of indoor air samples, drinking water, and ground water for these pollutants. Asbestos and silicate pollution in the workplace and asbestos-removal technology are considered in other bibliographies. (This updated bibliography contains 67 citations, all of which are new entries to the previous edition.)

13524 **(PB—89-853147/XAB) Asbestos and silicate pollution in the workplace. January 1971-December 1988 (Citations from the NTIS data base). Report for January 1971-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 179p. NTIS PC N01/MF N01.

Supersedes PB—87-855342.

This bibliography contains citations concerning occupational exposure to asbestos and silicate fibers in the workplace. Correlations are cited between occupational exposure, carcinogenesis, and mortality in some of the citations. Included are surveys of occupational exposure of shipyard workers, mechanics, miners, insulation installers, jewelers, and welders. Asbestos and silicate pollution-exposure standards, and hazard-control technology are cited. References to asbestos removal, and nonoccupational asbestos and silicate pollution are excluded and can be found in other bibliographies. (This updated bibliography contains 282 citations, 79 of which are new entries to the previous edition.)

13525 **(PB—89-853204/XAB) Hydrogen chloride air pollution. January 1970-December 1988 (Citations from the NTIS data base). Report for January 1970-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 208p. NTIS PC N01/MF N01.

Supersedes PB—86-863883.

This bibliography contains citations concerning hydrogen chloride pollution and the control of acid emissions. Surveys dealing with the environmental impact of acid emissions are included. Instrumentation for detection and measurement of acid emissions are considered. (This updated bibliography contains 307 citations, 105 of which are new entries to the previous edition.)

13526 **(PB—89-853808/XAB) Acid precipitation. September 1986-August 1987 (Citations from the Compendex data base). Report for September 1986-August 1987.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 131p. NTIS PC N01/MF N01.

See also PB—89-853816.

This bibliography contains citations concerning the causes, effects, sources, and controls of acid precipitation and acidification. Techniques and technology for measurement and analysis of acid precipitation are considered. (This updated bibliography contains 266 citations, none of which are new entries to the previous edition.)

13527 **(PB—89-853816/XAB) Acid precipitation. September 1987-December 1988 (Citations from the COMPENDEX data base). Report for September 1987-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 105p. NTIS PC N01/MF N01.

Supersedes PB—87-866620.

This bibliography contains citations concerning the causes, effects, sources, and controls of acid precipitation and acidification. Techniques and technology for measurement and analysis of acid precipitation are considered. (This updated bibliography contains 190 citations, all of which are new entries to the previous edition.)

13528 **(PNL—6687) An evaluation and analysis of three dynamic watershed acidification codes (MAGIC, ETD, and ILWAS).** Jenne, E.A.; Eary, L.E.; Vail, L.W.; Girvin, D.C.; Liebetrau, A.M.; Hibler, L.F.; Miley, T.B.; Monsour, M.J. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1989. Contract AC06-76RL01830. 253p. NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006388/JAW.

The US Environmental Protection Agency is currently using the dynamic watershed acidification codes MAGIC, ILWAS, and ETD to assess the potential future impact of the acidic deposition on surface water quality by simulating watershed acid neutralization processes. The reliability of forecasts made with these codes is of considerable concern. The present study evaluates the process formulations (i.e., conceptual and numerical representation of atmospheric, hydrologic geochemical and biogeochemical processes), compares their approaches to calculating acid neutralizing capacity (ANC), and estimates the relative effects (sensitivity) of perturbations in the input data on selected output variables for each code.

Input data were drawn from three Adirondack (upstate New York) watersheds: Panther Lake, Clear Pond, and Woods Lake. Code calibration was performed by the developers of the codes. Conclusions focus on summarizing the adequacy of process formulations, differences in ANC simulation among codes and recommendations for further research to increase forecast reliability. 87 refs., 11 figs., 77 tabs.

13529 **(UCRL—21004-Vol.1) Smokes and obscurants: A guidebook of environmental assessment: Volume 1, Method of assessment and appended data.** Shinn, J.H.; Sharmer, L.; Novo, M.; Katz, L.F. (Lawrence Livermore National Lab., CA (USA)). 4 Sep 1987. Contract W-7405-ENG-48. 225p. NTIS, PC A10/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006050/JAW.

Environmental assessments (EAs) are one type of document that can be required prior to the authorization of field tests of smokes and obscurants; EAs are documents that are written to comply with the National Environmental Policy Act (NEPA). This guidebook was prepared to facilitate the preparation of EAs for field tests of smokes and obscurants. The guidebook is divided into two volumes: Volume 1--Method of Assessment and Appended Data, and Volume 2--A Sample Environmental Assessment. This volume (Volume 1) is further divided into two major parts. Part 1 contains introductory material about the legal basis for EAs and general information about smokes and obscurants. Part 2 provides information about writing an EA. The major subjects that should be discussed in an EA, which are described in Part 2, include (1) an introduction, (2) a statement of the proposed action, (3) a description of the environmental setting, (4) a discussion of the physical, chemical, and biological properties of the smokes and obscurants being tested, (5) a discussion of impact criteria, (6) an identification of environmental effects, (7) a consideration of environmental consequences, (8) a discussion of the cumulative, long-term effects of repeated tests, (9) a discussion of short-term effects versus effects on long-term productivity, (10) a statement of recommended alternatives, (11) a consideration of mitigation, (12) recommendations for the next step in the NEPA process, and (13) references. Specific meteorological data for potential sites and distance to interim threshold values are also provided in Volume 1. 51 refs., 24 tabs.

13530 **(UCRL—21004-Vol.2) Smokes and obscurants: A guidebook of environmental assessment: Volume 2, A sample environmental assessment.** Shinn, J.H.; Sharmer, L.; Novo, M. (Lawrence Livermore National Lab., CA (USA)). 4 Sep 1987. Contract W-7405-ENG-48. 84p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006049/JAW.

Environmental assessments (EAs) are one type of document that can be required prior to the authorization of field tests of smokes and obscurants; EAs are documents that are written to comply with the National Environmental Policy Act (NEPA). This guidebook was prepared to facilitate the preparation of the EAs for field tests of smokes and obscurants. The guidebook is divided into two volumes: Volume I--Method of Assessment and Appended Data, and Volume II--A Sample Environmental Assessment. This volume (Volume II) presents the thirteen major sections of a sample environmental assessment through the use of explanatory material and hypothetical text. The major sections are (1) an introduction, (2) a statement of the proposed action, (3) a description of the environmental setting, (4) a discussion of the physical, chemical, and biological properties of the smokes and obscurants being tested, (5) a discussion of impact criteria, (6) an identification of environmental effects, (7) a consideration of environmental consequences, (8) a discussion of the cumulative, long-term effects of repeated tests, (9) a discussion of short-term effects versus effects on long-term productivity, (10) a statement of recommended alternatives, (11) a consideration of mitigation, (12) recommendations for the next step in the NEPA process, and (13) references. 3 refs., 16 figs., 8 tabs.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 12709, 12892, 13032, 13556

13531 **(CLOR—117/D) Measurement of concentration of /sup 90/Sr, /sup 106/Ru, /sup 125/Sb, /sup 137/Cs, /sup 144/Ce, /sup 210/Pb, /sup 226/Ra, U and stable Pb in the tropospheric and lower stratospheric air from 1973 to 1984.** Kownacka, L.; Jaworowski, Z.; Baranski, A.; Suplinska, M.; Lewitowicz, J.; Wesolek, R.; Romicki, Z. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland); Technical Air Force Institute, Warsaw (Poland); Institute of Aircraft, Warsaw (Poland)). (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)). 1985. 87p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705240/JAW.

Published in 1986.

The vertical distributions of the concentrations of /sup 210/Pb, /sup 226/Ra, U and stable Pb, as well as fission products introduced into the stratosphere by nuclear explosions, have been studied from 1973 above north eastern part of Poland. The measurements of the concentrations of /sup 90/Sr, /sup 137/Cs, /sup 144/Ce, /sup 226/Ra and stable Pb were carried from 1973 to 1977 in aerosol samples collected at the altitudes of 6, 8, 10 and 12 km. Besides, from 1979 the measurements of U and /sup 210/Pb were made at the same levels. From 1980 to 1984, excepting 1982, the samples were taken from the levels: 3, 6, 9, 12, 15 km. From 1975 ground level samples have been taken on the same day in the outskirts of Warsaw. 13 refs., 74 tabs.

13532 **(OEFZS—4463) Influence of the deposition-time on the specific activities of food and the derived radiation dosage by ingestion, calculated with the terrestrial food chain model ECOSYS.** Gerzabek, M.; Humer, H. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Landwirtschaft; Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Physik). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Aug 1988. 36p. (In German). (LA—202/88; PH—461/88). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705210/JAW.

A later deposition time (June) in the case of the Chernobyl-accident would have lead to higher specific activities in cereals (I-131, Cs-137, Sr-90), vegetables (Cs-137, Sr-90) and pork meat (Cs-137, Sr-90). The derived radiation dosage by ingestion would be 64% higher than the value calculated for May as deposition time. 3 refs., 22 figs., 24 tabs.

13533 **(OEFZS—4466) Cs 137 concentrations in important food samples from the 1987 harvest.** Mueck, K.; Karg, V. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. ASTRA-Reaktorinstitut; Bundesanstalt fuer Lebensmitteluntersuchung und Forschung Wien). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Sep 1988. 39p. (In German). (ST—161/88; AR—28/88). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705211/JAW.

By measuring 186 vegetation food samples of the harvest 1987 the /sup 134/Cs- and /sup 137/Cs-activity concentration averaged over Austria could be well established. The average /sup 137/Cs-concentration amounted to: cereals, cabbage: 0,59 Bq/kg; potatoes: 1,0 Bq/kg; lettuce: 2,4 Bq/kg; apple: 4,9 Bq/kg; pear: 7,6 Bq/kg. As expected these values were significantly below those of the harvest one year before. They amounted to between 3,2% (cereals) and 10% (apple, pear) of harvest 1986. These low activity concentrations result in correspondingly low ingestion dose values by vegetable food of 0,8 μSv/a for the adult, and 2,6 μSv/a for the one-year-infant. 10 refs., 33 tabs.

13534 **(PB—89-852743/XAB) Radon detection in homes and buildings. January 1970-December 1988 (Citations from the NTIS data base). Report for January 1970-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 147p. NTIS PC N01/MF N01.

Supersedes PB—88-855218.

This bibliography contains citations concerning the detection of radon and radon-daughter gases in homes and buildings. Measurement techniques and equipment, the effect of local geology on radon in a building, the effect of home-weatherization measures on radon levels, and sources of radon entering buildings are among the topics discussed. Residential and non-residential buildings are examined. Risk assessment and ways to control the amount of radon in a building are briefly considered. (This updated bibliography contains 232 citations, 46 of which are new entries to the previous edition.)

13535 **(SCPRI-RM—2-1988) Monthly Results of Measurements, February 1988.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Feb 1988. 43p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754955/JAW.

This report of the SCPRI exposes an interpretation of the principal results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, suface water, underground water, sewage water, drinking water, food chain (milk, vegetables, fishes), sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables. This report exposes also the results of special radiation measurements resulting from the Chernobyl accident.

13536 **(SCPRI-RM—3-1988) Monthly results of measurements, March 1988 with supplement related to 1988 first quarter.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Mar 1988. 64p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754956/JAW.

This report of the SCPRI exposes an interpretation of the principal results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface water, underground water, sewage water, drinking water, food chain (milk, vegetables, fishes), sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables. This report exposes also the results of special radiation measurements resulting from the Chernobyl accident.

5006 Regulations

13537 **(AD-A—200496/8/XAB) Corps of Engineers painting and its compliance with Clean Air Act regulations. Final technical report.** Beitelman, A.D. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Aug 1988. 53p. (CERL-SR-M—88/15). NTIS, PC A04/MF A01.

This report assesses the impact of the Clean Air Act (42 U.S. C. 7401 et seq.; P.L. 95-95), and of Army regulations on volatile organic compounds (VOCs) in particular, on Corps of Engineers painting specification. The researchers reviewed the paints specified in CEGS-09900, General Painting, CW-09940, Painting: Hydraulic Structures and Appurtenant Works, and CE-R-09.2, Painting, and found that many paints did not comply with restrictive regulations on VOC content. For each of these paints, the VOC content is given, and is given, and alternate, compliant paints are suggested.

13538 **(PB—89-106983/XAB) National Air Toxics Information Clearinghouse: NATICH data base report on state, local, and EPA (Environmental Protection Agency) air toxics activities. Interim report (Final).** (Radian Corp., Austin, TX (USA)). Jul 1988. 571p. (DCN—88-239-001-50-08). NTIS, PC A24/MF A01.

Supersedes PB—86-200466.

The purpose of this report is to disseminate information provided to the NATICH data base by State and local air agencies and EPA on their air-toxics activities. The computer-generated report supersedes manually- and computer-prepared reports published in September 1984, March 1985, September 1985, July 1986, and July 1987. It both updates and extends (in new tables) the information in the first five reports and contains information received through July 8, 1988. The report includes a listing of State and local agencies that have provided information to the Clearinghouse, air-toxics contacts, regulatory program information, acceptable ambient concentration guidelines or standards and the bases of those guidelines/standards, pollutant research information, methods development activities, permitting information, source testing information, etc.

13539 **(PB—89-118426/XAB) Waste-water treatment and receiving-water-body interactions.** Rossman, L.A. (Bureau of Mines, Washington, DC (USA)). Oct 1988. 50p. (EPA—600/D-88/206). NTIS, PC A03/MF A0.

Estimates are presented of the impact of the passage of five recently proposed acid rain bills on electric utility costs for coal-burning utilities servicing the domestic aluminum smelting industry, and on the costs of production for affected aluminum smelters. As aluminum smelting is an energy-intensive industry, domestic increases in electricity prices could affect the industry's competitiveness. Energy costs in U.S. aluminum smelting are compared to aluminum smelting energy costs in the rest of the world. Governmental policies affecting these energy costs are discussed.

13540 **(PB—89-118434/XAB) Asbestos problem resolution.** Cain, W.C.; Wilmoth, R.C.; Powers, T.J. (Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab.). Oct 1988. 10p. (EPA—600/D-88/209). NTIS, PC A02/MF A01.

This paper discusses the variety of regulations applicable to asbestos in buildings, ranging from the Clean Air Act to the Asbestos Hazard Emergency Response Act. Remedial actions are discussed (removal, enclosure, and encapsulation) and the ongoing research related to those areas is briefly described. Operational and interpretational problems with encapsulant use are also discussed.

13541 **(PB—89-122352/XAB) Potential impact of acid-rain legislation on the domestic aluminum-smelting industry: methodology and documentation.** Alvic, D.R. (Tennessee Univ., Knoxville (USA). Energy, Environment and Resources Center). Oct 1988. 68p. NTIS, PC A04/MF A01.

See also PB—89-122345.

This report describes the methodology and documentation employed in a detailed assessment of the potential economic impact of proposed federal acid-rain legislation for reducing sulfur oxide emissions on the U.S. aluminum-smelting industry, an energy-intensive industry which relies on coal combustion for electric power generation. The report documents the method and assumptions used in estimating the increased costs of electric power generation due to the proposed legislation, and the results of this estimation. Information is included on smelter activities, cost estimation procedures, model assumptions, and analysis approaches.

13542 **(PB—89-124366/XAB) Status of US EPA's (Environmental Protection Agency's) sludge-incinerator regulations.** Crumpler, E.P.; Rubin, A.B.; Bostian, H.E. (Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab.). Nov 1988. 8p. (EPA—600/D-88/231). NTIS, PC A02/MF A01.

This report describes a potential regulatory approach that the U.S. EPA could use for controlling sewage-sludge incinerators. The approach utilizes a most-exposed individual risk assessment to ensure that sludge-incineration air emissions will not cause an unacceptable health risk. An incinerator facility can demonstrate compliance using a three-tiered system which proceeds from a simple worst case calculation to a more resource intensive site-specific demonstration. A key part of the tiering system is development of an accurate and reliable emissions data base for U.S. sludge incinerators that can be used to develop reasonable worst case emission-control factors. The results of testing to date are discussed in the paper.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 13545

13543 **(DOE/SR/14069—1) Establishment of a viable population of red-cockaded woodpeckers at the Savannah River Plant: Progress report, 1985 through 1988.** Allen, D.H.; Lennartz, M.R. (Forest Service, Aiken, SC (USA). Southeastern Forest Experiment Station). 6 Dec 1988. Contract AI09-85SR14069. 79p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005957/JAW.

In 1985 the Southeastern Forest Experiment Station (SEFES) in cooperation with the Department of Energy began research on the red-cockaded woodpecker (RCW) at the Savannah River Plant (SRP). In early 1986 there were four RCW's on the SRP, including one pair in colony 19 and solitary males in colonies 5 and 16. Because of the decline in past years, it was deemed necessary to bring in birds from outside the plant to augment the local RCW population. In the next two years, translocations and local reproduction increased the population to 14 birds and the number of breeding clans from one to three. Although only two clans bred and fledged young in 1988, the population remains at 14 birds and has expanded to occupy five colony sites. Research and management activities implemented or continued over the past year include: translocations of birds within the SRP and from the Francis Marion National Forest (FMNF) to SRP, herbicide, burning and thinning for hardwood control and increased diameter growth of pines, the removal of flying squirrels from active colonies, and the installation of nest boxes, RCW artificial cavities and metal restrictors to reduce competition from other species.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 13566, 13580, 13581, 13585

13544 **(AD-A—200173/3/XAB) Field-Verification Program: summary of the US Army Corps of Engineers/US Environmental Protection Agency Field-Verification Program. Final report.** Peddicord, R.K. (Battelle Ocean Sciences, Duxbury, MA (USA)). Oct 1988. 55p. NTIS, PC A04/MF A01.

The US Army Corps of Engineers/US Environmental Protection Agency Field-Verification Program was a 6-year, $7.2 million study of upland disposal, wetland creation, and aquatic disposal with dredged material. The program was designed to determine (a) the reproducibility of test methods in the laboratory, (b) the ability of laboratory test methods to predict effects in the field, and (c) the comparative effects of the same material in upland, wetland, and aquatic environments. The program demonstrated that effluent and surface water-quality prediction methods have good utility for predisposal evaluation of dredged material proposed for upland disposal. Methods for testing toxicity and bioaccumulation in wetland plants showed good predictive ability. However, optimum utility for predictive evaluations of the upland and wetland animal bioassays awaits further confirmation of the reproducibility of the test results in the laboratory. Methods with good utility for evaluating dredged material proposed for aquatic disposal include toxicity, bioaccumulation, intrinsic rate of population growth, and scope for growth.

13545 **(CNIC—00156) Effects of /sup 35/S-dimehypo pesticide on agricultural environment and ecosystem.** Chen Zuyi; Mi Chunyun; Ye Dechang; Cheng Bing. (Nanjing Agricultural Univ., JS (China)). (China Nuclear Information Centre, Beijing, BJ). Mar 1988. 12p. (In Chinese). (U32-NAU—0016). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705063/JAW.

Dimehypo is a nereistoxin derivative, which was developed and manufactured in China. In order of appraise its environmental safety comprehensively, the radioisotopic tracer technique and other methods were applied to investigate on the effects of /sup 35/S-labelled dimehypo (/sup 35/S-dimehypo) on agricultural environment and ecosystem. The results revealed its low adsorptivity and high mobility, especially water-carrying mobility in soil, fair stability in soil and water, and slowness in degradation. Its main product of degradation, nereistoxin, was of lower mobility than its material compound in soil. /sup 35/S-dimehypo could enter the bodies of grass carps Ctenopharyngodon idellus along with bails or via the respiratory tracts, and could be excreted fast after the fish were removed from the contaminated source. Liquid and granulated /sup 35/S-dimehypo were fed to quail and fowls respectively, and could also be excreted rapidly in excretion and urine. Its much less distribution coefficient in caprylalcoholwater system suggested no accumulation in the adipose tissue of organism. The release of its effective composition in the granules prepared with porcelain clay or clay soil is prompt and complete.

13546 **(CONF-8810133—4) Improved luminescence technique for screening aromatic contaminants in environmental samples.** Gammage, R.B.; Miller, G.H.; Haas, J.W. III; Vo-Dinh, T. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003928/JAW.

From 1. international symposium on field screening methods for hazardous waste site investigations; Las Vegas, NV, USA (11 Oct 1988).

The sensitive spectroscopic technique of synchronous fluorescence (SF) is readily applied to screening environmental samples for semi-volatile aromatic contaminants. The technique is applicable to water and soil samples, either directly as water or as solvent extracts. This screening technique permits identification of semivolatile EPA priority pollutants or groups of pollutants, such as polynuclear aromatic (PNA) hydrocarbons of common ring size, in key environmental samples. Conversely, negligibly contaminated samples requiring no further analyses and expense can be screened out. Examples are given of coarse but direct screening analyses of contaminated samples of groundwater. The total synchronously measured fluorescence has been expressed in units of total PNA referenced to the SF from a standard reference sample of sixteen PNA compounds. 7 refs., 5 figs.

13547 **(LA—11478-PR) Water supply at Los Alamos during 1987: Progress report.** Purtymun, W.D.; Stoker, A.K.; Maes, M.N. (Los Alamos National Lab., NM (USA)). Jan 1989. Contract W-7405-ENG-36. 40p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005751/JAW.

Municipal and industrial water supply during 1987 was 1594 {times} 10^6 gal from wells in three fields and 34 {times} 10^6 gal from the spring gallery in Water Canyon. About 2.8 {times} 10^6 gal of nonpotable water from the Guaje Reservoir and 3.2 {times} 10^6 gal from the Los Alamos Reservoir were used for irrigation; thus, the total water usage in 1987 was about 1634 {times} 10^6 gal. Water supply was satisfactory in that the production met demand and water quality in the distribution system was in compliance with state and federal regulations. However, in 1987 two wells were lost because of deterioration of the casing and screen. In spite of rehabilitation attempts to maintain the yield, production from the older wells continued to decline. A comprehensive evaluation of the wells and well fields made in late 1987 concluded that replacement wells and new wells were needed soon to ensure a reliable water supply for the Laboratory and the county of Los Alamos. 25 refs., 6 figs., 7 tabs.

13548 **(PB—89-124648/XAB) Treatment of hazardous landfill leachates and contaminated ground water. Final report, October 1980-October 1986.** Ahlert, R.C.; Kosson, D.S. (Rutgers--the State Univ., Piscataway, NJ (USA). Dept. of Chemical and Biochemical Engineering). Nov 1988. 290p. NTIS, PC A13/MF A01.

This study assessed the application of separate or combined biological and physical/chemical treatment techniques to high-strength hazardous dumpsite or landfill leachates, extractable wastes and spills, or sludges. Four types of real-world toxic, concentrated, complex wastes served as prototype waste streams: industrial-landfill leachate, leachate from an industrial-sludge impoundment, forced extract from impounded industrial sludge, and ground water

contaminated with chlorinated solvent. Field pilot plants were constructed and operated to demonstrate sequential aerobic/anaerobic soil-based microbial treatment for leachates from two sites and for ground water contaminated with 1,1,1-trichloroethane at a third site. Even in the presence of high concentrations of inorganic salts, organic-carbon reductions up to 99% were readily achieved. The levels of chlorinated solvents extracted in subsurface water were reduced from 5 mg/L to less than 20 ng/mL (greater than 99.6%).

13549 (PB—89-129670/XAB) Lining of waste-containment and other impoundment facilities. (Matrecon, Inc., Alameda, CA (USA)). Sep 1988. 1030p. NTIS, PC A99/MF E04.

See also PB—86-192796.

This report provides current technological information on liner and cover systems for waste storage and disposal units. The various materials used in the construction of these systems are discussed, with particular emphasis on polymeric flexible membrane liners. The types and properties of wastes that may be impounded in land storage and disposal units and the constituents of these wastes that can affect lining materials are discussed. The conditions inside a containment unit are described. Elements of the design, specification, construction, quality assurance, and maintenance of a lined waste-containment unit are discussed. Costs for the components of a lining system, including their installation and construction, are presented. Several test methods are included.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 12677, 12959, 12965, 13533, 13535, 13536

13550 (CNIC—00114) Study on Cs and Sr transport in stratum. Bai Qingzhong; Yuan Guangyu. (Qinghua Univ., Beijing, BJ (China)). (China Nuclear Information Centre, Beijing, BJ). Dec 1987. 15p. (In Chinese). (TSHU—0002). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705050/JAW.

The adsorption distribution coefficient Kd and retardation factor R/sub d/ of Cs and Sr in the sandy soil medium were studied by static adsorption and dynamic simulation test. The results of static test showed that in case of low concentration of nuclides in solution, the Kd value of Sr and Cs was basically constant; in case of high concentration, with the increase of concentration of nuclides, the Kd value decreased. The decrease of pH value and the increase of the content of other positive ions will lead to the decline of Kd value. Dynamic experiments showed that migration speed of Cs was much smaller than that of Sr. It is pointed out that the Kd value of static test, although different from that of dynamic test, both of them had an identity of change tendency. Therefore, from the point of view of theory and practice, the further static adsorption test is necessary. The dynamic simulation test in laboratory should be strenthened and systemized in order to provide a significant guide to in-situ test. It is important to control the concentration of nuclides in both of the test.

13551 (EPA/520/5—88-021) A long-term study of radon and airborne particulates at phosphogypsum stacks in central Florida. Horton, T.R.; Blanchard, R.L.; Windham, S.T. (Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility). Oct 1988. 214p. Environmental Protection Agency, 401 M Street, South West, Washington, DC 20460. Order Number TI89006047/JAW.

The EPA is presently assessing the significance of radioactive emissions from phosphogypsum stacks to determine if they should be regulated under the Clean Air Act. As part of this assessment, a one-year study was conducted to measure the airborne radionuclide emissions from five phosphogypsum stacks in central Florida. This report provides a detailed description of this study. Measurements were conducted over a 12-month period on four active and one inactive phosphogypsum stacks. The study included the following measurements: 1260 radon-222 flux, 90 ambient radon-222, and 50 gamma-ray exposure rates. Also, radionuclide analyses were performed on 33 airborne particulate samples, 9 airborne particle-size samples, and 50 phosphogypsum samples. The annual average radon flux determined for the dry-loose material on top of active phosphogypsum stacks was 20 pCi/m^2-s, and is regarded as representative of stacks in the central Florida region. The annual average flux on the top surface of the inactive stack was 4 to 5 times smaller, due to a surface crust. The data suggest that to obtain a representative annual average radon flux on a phosphogypsum stack the total number of measurements made is more important than the period of time over which the measurements are made. 11 ref., 16 figs., 24 tabs.

13552 (INFO—0237) Transfer of radionuclides at the uranium and thorium decay chains in aquatic and terrestrial environments. Letourneau, C. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Apr 1987. 82p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705136/JAW.

French version included as INFO--0237(F).

This report examines the transfer of radionuclides from the uranium and thorium decay chains (U-238, Ra-226, Th-232, Th-230, Po-210 and Pb-210) through the aquatic and terrestrial environment. This transfer is characterized by a transfer coefficient; environmental and experimental factors which cause this coefficient to vary are presented and discussed in this report. Furthermore, based on a literature survey, the report indicates the range of coefficients found for the aquatic sector (that is, sediment and freshwater and marine organisms) and for the terrestrial sector (that is, plants and domestic and wild animals). Afterwards, generalisations are formulated on the transfer of the different radionuclides through the multiple environmental compartments. 75 refs.

13553 (INIS-GB—168) Third annual report of RADMIL for the period 1.4.87 to 31.3.88. (Radioactivity Monitoring in Lancashire (RADMIL), Lancaster (UK)). 1988. 52p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756023/JAW.

This is RADMIL's Third Annual Report and fifth report in a series of reports on the Lancashire environment. Two of the reports dealt specifically with the consequences of the Chernobyl Accident on Lancashire monitoring. Since its inception the RADMIL monitoring has been continually developed and improvements in monitoring are noted in this report. The RADMIL programme now embraces measurements in the following areas: measurements related to external radiation exposure (environmental gamma monitoring, beach and coastline surveying, coastline sediments) and measurements related to internal contamination(airborne particulates, milk, fish and shellfish, fruit and vegetables, other materials, radon). Radon is reported separately. (U.K.).

13554 (SKB-TR—87-28) Radionuclide deposition and migration within the Gideaa and Finnsjoen study sites, Sweden: A study of the fallout after the Chernobyl accident. Phase I, initial survey. Gustafsson, E.; Skaalberg, M.; Ittner, T.; Carbol, P.; Eriksson, N.; Sundblad, B.; Karlberg, O.; Lampe, S.; Tullborg, E.L. (Swedish Geological Co., Uppsala; Chalmers Univ. of Tech., Goeteborg (Sweden); Studsvik Energiteknik AB, Nykoeping (Sweden); Swedish Geological Co., Goeteborg). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Chalmers Univ. of Tech., Goeteborg (Sweden); Studsvik Energiteknik AB, Nykoeping (Sweden)). Dec 1987. 180p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88756527/JAW.

Radionuclides originating from the Chernobyl accident in April 1986 were deposited over large areas of Sweden. The distribution and migration of the radionuclides during the first months after deposition were measured in a comprehensive survey within two study sites, Gideaa in Aangermanland county and Finnsjoen in Uppland county. The sites are previously investigated in the SKB site characterization programme and well defined regarding geology and hydrology. Radionuclides analysed are: Mn-54, Co-60, Sr-90, Zr-95, Nb-95, Mo-99, Ru-103, Ru-106, Ag-110m, Sb-125, I-131, Cs-134, Cs-136, Cs-137, Ba-140, La-140, Ce-141 and Ce-144. The CS-137 surface activity gave a range of 30-100 kBq/m/sup 2/ in Gideaa and 20-40 kBq/m/sup 2/ in Finnsjoen. Radionuclide migration is observed in soil profiles, groundwater and rock fissures. An active transport by surface water is also evident from sediment samples. Radionuclides have been absorbed in different types of vegetation.

13555 **(SSI—88-03) Gamma monitoring stations. Annual report 1987.** Kjelle, P.E. (National Inst. of Radiation Protection, Stockholm (Sweden)). 25 Feb 1988. 540p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756208/JAW.

Since 1959 twentyfive gamma monitoring stations covering the whole country have been in continuous operation in Sweden. The measurements are made with a recording gamma monitor 2.5 metres above the ground. The sensor is a high-pressure ionization chamber with an equivalent air volume of 80 litres. The lower cut-off energy level is 60 keV. The report presents the results from 1987 in both diagrams and tables and for 1986 in diagrams. In the diagrams are the levels compared with the 1985 levels i.e. before the accident at Chernobyl. The fallout deposits hitting Sweden after the nuclear accident at Chernobyl vary from one place to another both with respect to magnitude and to nuclide composition. This depends on whether the fallout was dry or wet. The subsequent transport of the nuclides in the ground (migration) depends on type of soil. An important factor is whether the soil is under cultivation or not. In the latter case a large root carpet where the nuclides are slowed down. All the stations are placed on non-cultivated ground, mostly a grassy space, in some cases on a stony ground. The results from the monitoring stations show that the nuclide transport mostly is slow. A few exceptions are shown where the migration was bigger. At these stations the soil is rich in stones. The results from each station are separately described. (With 23 refs.) (O.S.).

13556 **Radionuclide transport from soil to air, native vegetation, kangaroo rats and grazing cattle on the Nevada test site.** Gilbert, R.O.; Shinn, J.H.; Essington, E.H.; Tamura, T.; Romney, E.M.; Moor, K.S.; O'Farrell, T.P. (Pacific Northwest Laboratory, Richland, WA (USA)). *Health Physics;* **55**: No. 6, 869-887(Dec 1988).

Between 1970 and 1986 the Nevada Applied Ecology Group (NAEG), U.S. Department of Energy, conducted environmental radionuclide studies at weapons-testing sites on or adjacent to the Nevada Test Site. In this paper, NAEG studies conducted at two nuclear (fission) sites (NS201, NS219) and two nonnuclear (nonfission) sites (Area 13 [Project 57] and Clean Slate 2) are reviewed, synthesized and compared regarding (1) soil particle-size distribution and physical-chemical characteristics of 239 + 240Pu-bearing radioactive particles, (2) 239 + 240Pu resuspension rates and (3) transuranic and fission-product radionuclide transfers from soil to native vegetation, kangaroo rats and grazing cattle. The data indicate that transuranic radionuclides were transferred more readily on the average from soil to air, the external surfaces of native vegetation and to tissues of kangaroo rats at Area 13 than at NS201 or NS219. The 239 + 240Pu resuspension factor for undisturbed soil at Area 13 was three to four orders-of-magnitude larger than at NS201 and NS219, the geometric mean (GM) vegetation-over-soil 239 + 240Pu concentration ratio was from ten to 100 times larger than at NS201, and the GM GI-over-soil, carcass-over-soil and pelt-over-soil 239 + 240Pu ratios for kangaroo rats were about ten times larger than at NS201. These results are consistent with the finding that Area 13, compared with NS201 or NS219, has a higher percentage of radioactivity associated with smaller soil particles and a larger percentage of resuspendable and respirable soil. However, the resuspension factor increased by a factor of 27 at NS201 when the surface soil was disturbed, and by a factor of 12 at NS219 following a wildfire.

13557 **The comprehensive environmental assessment and response program (CEARP).** Soden, C.; Vocke, R.W.; Stoker, A.K. (U.S. Dept. of Energy, Albuquerque Operations Office, Albuquerque, NM (US));. pp v of Proceedings of the fourth annual hazardous materials management conference. Wheaton, IL; Tower Conf. Management Company (1986). (CONF-860695—).

From HazMat '86: hazardous materials management conference and exhibition; Atlantic City, NJ, USA (2 Jun 1986).

The U.S. Department of Energy's (USDOE) Albuquerque Operations Office installations are being evaluated under its Comprehensive Environmental Assessment and Response Progrem (CEARP). The installations consist of eight weapons development and production facilities, which are located across the United States. The evaluation covers the major environmental regulations, with emphasis on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and on the Resource Conservation and Recovcry Act (RCRA). The CEARP is intended to help fulfill USDOE obligations for federal facilities under the U.S. Environmental Protection Agency (USEPA) CERCLA Program and constitutes the same basic approach as contained in USEPA guidance to federal facilities. The Program is a phased program to identify, assess, and correct existing and potential environmental concerns relative to these regulations. The five phases are Phase I - Installation Assessment, Phase II - Confirmation, Phase III - Technological Assessment, Phase IV - Remedial Action, and Phase V - Compliance and Verification.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 12539, 12738, 13543, 13551

5106 Regulations

13558 **(PB—89-124416/XAB) Incineration of a chemically contaminated synthetic soil matrix (SSM) using a pilot-scale rotary-kiln system.** Esposito, M.P.; Taylor, M.L.; Bruffey, C.L.; Thurnau, R.C. (PEI Associates, Inc., Cincinnati, OH (USA)). Nov 1988. 31p. NTIS, PC A03/MF A01.

The paper details part of the initial work conducted from June to November 1987 under Phase I of EPA's Superfund research program. In this segment of the program, a surrogate Superfund soil bearing a wide range of chemical contaminants typically occurring at Superfund sites was subjected to treatment by rotary-kiln incineration. A series of 6 test burns were conducted, a complete set of process and emissions samples were collected and analyzed, and the results are reported herein.

13559 **(PB—89-128391/XAB) Superfund record of decision (EPA Region 9): Operating Industries, California, November 1987. Second remedial action.** (Environmental Protection Agency, Washington, DC (USA)). 16 Nov 1987. 45p. (EPA/ROD/R—09-88/017). NTIS, PC A03/MF A01.

Over its 36-year life span, the Operating Industries, Inc. (OII) landfill has accepted several types of waste. In 1979, Getty Synthetic Fuels, Inc. (GSF) extracted gas from the landfill for processing and sale. After several permitting denials, GSF abandoned the gas extraction operations in 1987, which were taken over by EPA. Both landfill gas and leachate are generated by the OII site. Since October 1984, collected leachate has been stored onsite in tanks and transported to a permitted offsite treatment facility. Approximately 10,000 gallons of leachate will be collected before implementation of a final site remedy. The leachate contains VOCs including: benzene, TCE, toluene, and vinyl chloride. Remedial action for this site is discussed.

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5201 Basic Studies

13560 **(PB—89-123640/XAB) Current, ctd, and pressure measurements in possible dispersal regions of the Chukchi Sea. Final report.** Hachmeister, L.E.; Vinelli, J.B. (Washington Univ., Seattle (USA). School of Oceanography). May 1984. 78p. NTIS, PC A99.

The Chukchi is the northeastern end of the great Arctic Continental Shelf system, the world's largest, which surrounds the northern Eurasian land mass. These vast shelf seas are remarkably wide and shallow, typically 600-800 km and 50 m respectively, characteristics which greatly affect marine conditions. Oceanographically, the Chukchi Sea is an area of great contrasts. While in many respects it is an adjoining shelf sea of the Arctic Ocean, much as the East Siberian or the Laptev Sea is, it is also anomalous in that it is the recipient of the large northward discharge of the North Pacific through Bering Strait. The nutrient-rich waters, car-

rying Pacific planktonic life forms, define a migratory pathway between the Arctic and the Pacific for a great variety of animals, including marine mamals.

13561 **(PB—89-126650/XAB) Coastal circulation along Washington and Oregon. Volume 1. Executive summary.** Short, K.S.; Hachmeister, L.E. (Envirosphere Co., Bellevue, WA (USA)). Oct 1988. 14p. NTIS, PC A03/MF A01.

See also Volume 2, PB—89-126668.

The study was designed to evaluate the existing state of knowledge with respect to coastal ocean circulation off the Pacific Northwest. The objectives of the study were to: (1) identify all available major data sets of physical oceanographic observations along the Washington and Oregon coast; (2) to determine and describe the accessibility of these data; and (3) to evaluate the adequacy of the data base for describing circulation assess on the continental shelf. A total of 73 data sets from experiments spanning the period 1915 to 1988 were identified.

13562 **(PB—89-126668/XAB) Coastal circulation along Washington and Oregon. Volume 2. Project description, analysis, and recommendations.** Short, K.S.; Hachmeister, L.E. (Envirosphere Co., Bellevue, WA (USA)). Oct 1988. 71p. NTIS, PC A04/MF A01.

See also Volume 1, PB—89-126650 and Volume 3, PB—89-126676.

The study was designed to evaluate the existing state of knowledge with respect to coastal ocean circulation off the Pacific Northwest. The objectives of the study were to: (1) identify all available major data sets of physical oceanographic observations along the Washington and Oregon coast; (2) to determine and describe the accessibility of these data; and (3) to evaluate the adequacy of the data base for describing circulation assess on the continental shelf. A total of 73 data sets from experiments spanning the period 1915 to 1988 were identified.

13563 **(PB—89-126676/XAB) Coastal circulation along Washington and Oregon. Volume 3. Appendices.** Short, K.S.; Hachmeister, L.E. (Envirosphere Co., Bellevue, WA (USA)). Oct 1988. 427p. NTIS, PC A19/MF A01.

See also Volume 2, PB—89-126668.

The study was designed to evaluate the existing state of knowledge with respect to coastal ocean circulation off the Pacific Northwest. The objectives of the study were to: (1) identify all available major data sets of physical oceanographic observations along the Washington and Oregon coast; (2) to determine and describe the accessibility of these data; and (3) to evaluate the adequacy of the data base for describing circulation assess on the continental shelf. A total of 73 data sets from experiments spanning the period 1915 to 1988 were identified.

13564 **(PB—89-126692/XAB) California seabird ecology study. Volume 1. Feeding ecology of California nesting seabirds. Final report.** Tyler, W.B.; Spear, L.B.; Ferris, L.A.; Briggs, K.T.; Ainley, D.G. (California Univ., Santa Cruz (USA)). 15 Nov 1988. 168p. NTIS, PC A08/MF A01.

See also Volume 2, PB—89-126700.

This studies comprise three elements designed to augment MMS' ability to predict impacts to nesting seabirds that might result from exploration and production of oil and gas on the California Outer Continental Shelf. The first element consisted of a synthesis of existing literature and an analysis of several unpublished sources of information on the feeding ecology of ten seabird species whose aggregate nesting populations at Castle Rock, the Farallon Islands, or the Channel Islands exceeded 2,000 individuals. Analyses of satellite images of ocean surface temperature and color to determine recurrence, persistence, and other aspects of coastal upwelling formed the second element. Based on these studies, the third element, a field study of feeding ecology of Common Murres and Cassin's Auklets in central California, was conducted in 1985. The present volume brings together the findings of the first and third elements, while the companion volume presents results of studies of satellite imagery.

13565 **(PB—89-126718/XAB) Review of recovery and recolonization of hard substrate communities of the Outer Continental Shelf. Final report.** Lissner, A. (Science Applications International Corp., San Diego, CA (USA)). Jun 1988. 137p. NTIS, PC A07/MF A01.

This report summarizes knowledge of how marine benthic communities off California respond to both natural and anthropogenic disturbances. The results from the study will aid the MMS in making environmental assessments and management decisions associated with potential oil and gas leasing, exploration, and development activities. The objectives of the report on recovery and recolonization are: (1) to review relevant recovery and recolonization studies, pertinent life-history information, and data gaps.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 12597, 12600, 12601, 12710, 13071, 13243, 13244, 13522, 13523, 13526, 13527, 13529, 13530, 13544, 13545, 13548, 13549, 13655, 13658, 13707

13566 **(AD-A—199722/0/XAB) Evaluation of graphite for environmental toxicity using the standard aquatic microcosm. Technical report, June 1986-March 1987.** Landis, W.G.; Chester, N.A.; Haley, M.V.; Johnson, D.W.; Tauber, R.M. (Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD (USA)). Aug 1988. 21p. (CRDEC-TR—88133). NTIS, PC A03/MF A01.

The impact of a graphite dust on an aquatic ecosystem model, the Standard Aquatic microcosm (SAM), was investigated. Graphite dust produced effects that resembled eutrophication in that a diversity decreased, ammonia increased, and a photosynthesis/respiration ratio of less than one was observed in the highest concentration. Compared to brass dust, graphite has much less potential to adversely impact aquatic ecosystems.

13567 **(AD-A—200105/5/XAB) Development of the pipe-loop system for determining effectiveness of corrosion-control chemicals in potable water systems. Final report.** Prakash, T.M.; Scholze, R.J.; Neff, C.H.; Maloney, S.W.; Heath, M. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Aug 1988. 60p. (CERL-TR-N—88/12). NTIS, PC A04/MF A01.

In the Army's 12,000 miles of water lines, internal corrosion slowly destroys a large investment and creates significant problems for Army water-treatment-plant operators, who try to maintain the water quality at acceptable levels. Corrosion can be slowed using corrosion-inhibiting chemicals, but it is difficult to measure the extent of corrosion and the effectiveness of inhibitors without excavating actual pipes. This study surveyed corrosion-inhibiting water-quality control chemicals and methods for monitoring corrosion. With this knowledge, a pipe-loop system was developed and installed at Fort Bragg, NC and Fort Monroe, VA. It was shown to be effective in gathering data on corrosion rates. After a standard procedure has been established, this loop will allow a water-treatment-plant operator to monitor with ease the effectiveness of corrosion-inhibiting treatments.

13568 **(AD-A—200175/8/XAB) Field-Verification Program (aquatic disposal): synthesis of research results: applicability and field verification of predictive methodologies for aquatic dredged-material disposal. Final report.** Gentile, J.H.; Pesch, G.G.; Lake, J.; Yevich, P.P.; Zaroogian, G. (Environmental Protection Agency, Narragansett, RI (USA). Environmental Research Lab.). Sep 1988. 76p. NTIS, PC A05/MF A01.

The Field-Verification Program was designed to determine the applicability, reproducibility, and field verification of test methods for the evaluation of disposal of dredged material at aquatic, upland, and wetland sites. There were three objectives in this program. The first was to demonstrate the applicability of existing test methods to detect and measure effects of dredged material and to determine the degree of variability and reproducibility inherent in the testing procedures. The second objective was to field verify laboratory responses by comparing the exposure-response relationships between the laboratory and field. The third objective was to

determine the degree of correlation between contaminated tissue residues and biological responses resulting from laboratory and field exposure to dredged material. These objectives were examined for the following biological responses: bioaccumulation, scope for growth, bioenergetics, adenylate energy charge, sister chromatid exchange, histopathology, survival, growth, reproduction, intrinsic rates of population growth, recolonization, and community structure.

13569 **(AD-A—200434/9/XAB) Artificial intelligence for US Army wastewater treatment plant operation and maintenance. Final report.** Kim, B.; Bandy, J.; Gidwani, K.; Shelton, S. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Sep 1988. 46p. (CERL-TR-N—88/26). NTIS, PC A03/MF A01.

As the Army faces increasing reductions in budget and personnel for supporting functions such as operation and maintenance (O&M) of waste-water treatment plants (WWTPs), it is clear that reliance on automation will continue to grow. While computer systems will not replace operators, they will provide valuable assistance in optimizing the operator's time and effort. Findings suggest that AL/expert systems technology is not yet at an economically practical level for use in O&M of the Army WWTPs. However, as the technology becomes refined and produced at lower cost, it should be reconsidered; this study has shown through a proof-of-concept exercise that AL/expert systems have potential value to the O&M process.

13570 **(AD-A—200590/8/XAB) Ground-water model calibration for a hydrocarbon plume in a sandy, surficial aquifer. Master's thesis.** Scanlan, S.R. (Naval Postgraduate School, Monterey, CA (USA)). Dec 1988. 188p. NTIS, PC A09/MF A01.

A gasoline-contaminated surficial aquifer, the site of four years of remediation efforts, was investigated using a semi-quantitative soil-extraction procedure to determine the vertical distribution of sorbed contaminants present. The effectiveness of contaminant flushing in highly contaminated soils by aquifer augmentation was demonstrated. The site was modeled using BIOPLUME II, an updated version of the USGS Solute Transport Model. Although the model was effectively calibrated to the ground-water flow through the site, the extreme vertical contaminant concentrations as a function of aquifer elevations and time prevented the acceptable calibration of the pollutant transport model to this site. A three dimensional model should be considered.

13571 **(CONF-8806169—2) Upward migration of underground injected wastes through hydrologic conduits around the wellbore.** Chia, Yeeping; Chiu, J. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 23p. NTIS, PC A03 - OSTI. Order Number DE89005839/JAW.

From 4. annual Canadian/American conference on hydrogeology; Banff, Canada (22 Jun 1988).

Underground injection, compared to other waste disposal methods, is considered to have the advantages of isolating wastes in a confined brine aquifer well below the horizon of human activity and underground sources of drinking water (USDWs). While most of injected wastes move laterally in the injection zone, posing a long-term concern to the human health and environment, a small amount can migrate upward to the upper aquifers, causing a greater threat to the quality of USDWs. Both the dual porosity and the single porosity models were used to investigate the migration of injected wastes through these hydrologic conduits. The results indicate that regional upward migration through an extensive confining formation is a slow process. Nevertheless, injected wastes can move upward rapidly through microannuli and channels in the cement sheath and spread over a distance in the upper aquifer. The wastes can also migrate fast through fractures in the disturbed zone. The study further suggests that upward-migrated contaminants through cement and disturbed zone can be significantly diluted if one or more permeable strata exist between the injection zone and USDWs. This study concludes that a critical assessment of upward contaminant migration through hydrologic conduits around the wellbore is essential to ensure the feasibility of underground injection operations. 9 refs., 6 figs.

13572 **(DOE/ER/60451—3) Production and turnover of suspended organic detritus in the coastal water of the southeastern continental shelf: Progress report, June 1, 1988--May 31, 1989.** Pomeroy, L.R. (Georgia Univ., Athens (USA). Inst. of Ecology). 1 Dec 1988. Contract FG09-86ER60451. 154p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005912/JAW.

As one of a group cooperative research projects on the southeastern continental shelf, this project is concerned with specific aspects of microbial processes and related phenomena that influence the fate of particulate organic materials naturally produced on the continental shelf. The projects of other grantees encompass the dynamics of the shelf from physical oceanography to biology. The integrated information as a whole will be useful in understanding the potential fate of a variety of energy related pollutants that may be released in continental shelf waters. With a focus on events on the southeastern continental shelf and their boundary conditions (Gulf Stream dynamics; river and estuarine processes), we form an interface between studies of oceanic processes such as GOFS and WOCE, and studies of processes at the land-sea boundary. During this grant year we completed two research cruises on the southeastern continental shelf on R/V Blue Fin, and processed data from previous cruises.

13573 **(PB—89-115513/XAB) Predicting potential aluminum contamination of surface and ground waters from acid-sulfate-enriched drainages emanating from low-neutralization-capacity watersheds. Research report.** Karathanasis, A.D.; Evangelou, V.P.; Thompson, Y.L. (Kentucky Univ., Lexington (USA). Water Resources Research Inst.). Aug 1988. 87p. (RR—170). NTIS, PC A05/MF A01.

The composition of soil solutions and surface waters emanating from unreclaimed, or partially reclaimed, strip-mined watersheds with low buffering capacity in Kentucky were compared with soil-solution compositions of unaffected strata in the watershed. The data suggest that, almost 20 years after mining, most soil solutions and surface waters of the disturbed areas still contain high levels of dissolved Al, controlled primarily by the solubilities of a jubanite-like mineral (upper limit) and alunite (lower limit). Soluble Al in solutions of undisturbed areas was consistent with the solubility of laolinite or gibbsite. The absence of jubanite x-ray diffraction peaks suggested the presence of an amorphous mineral or one stoichiometrically similar to jurbanite. The control of soluble Al by basic aluminum sulfate minerals was not affected by the variable mineralogical and tectural composition of soil and geological strata in the watershed.

13574 **(PB—89-121685/XAB) Quantitation of acrylamide (and polyacrylamide): critical review of methods for trace determination/formulation analysis and future-research recommendations. Final report.** Daughton, C.G. (Daughton (Christian G.), Orinda, CA (USA)). 1988. 64p. (CGD—02/88). NTIS, PC A04/MF A01.

Polyacrylamides (esp. polyelectrolytes) have gained wide usage in water treatment (as flocculants/coagulants), tertiary oil recovery, and various other applications such as sewer grouts. Unreacted, residual acrylamide monomer (2-propenamide: CH2=CH-C(=O)-NH2) is usually present in the various bulk commercial formulations at low fractional percentages. Although the polymers are relatively nontoxic, acrylamide can elicit severe neurotoxicity and genotoxicity. For health concerns, use of polyacrylamides in drinking water has been subjected to closer evaluation during the last decade. Currently, dosage standards are indirectly based on the maximum concentration of acrylamide that would result from use of a commercial formulation of known acrylamide content. Although numerous methods of chemical analysis exist for determining the acrylamide content of a polyacrylamide formulation, no standardized method has been adopted for directly determining trace concentrations of acrylamide in water (e.g., at the sub-parts-per-billion level, ng-micrograms/L). This report represents the first in-depth literature review of methods for determining acrylamide monomer. Over 100 references were reviewed, and those that deal specifically with acrylamide determination are annotated in detail. The approach was to unify the general chemistry of acrylamide (and amides) with the published methods for quantitation.

13575 **(PB—89-124465/XAB) Total organic halide measurements.** Dressman, R.C.; Stevens, A.A. (Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab.). Nov 1988. 21p. (EPA—600/D-88/234). NTIS, PC A03/MF A01.

Currently, the most popular method of analyzing total dissolved halide in water involves carbon adsorption, oxidative combustion, and measurement of the hydrogen halide by microcoulometry. Total dissolved organic halide can be used as an indicator of water quality, providing a direct measure of disinfection by-product formation and, in some circumstances, a surrogate measure of individual organic pollutants. An important application of organic halide measurements is in unit process design, control, and monitoring. Each potential application, however, must be carefully assessed to determine the usefulness of organic halide measurements.

13576 **(PB—89-125934/XAB) Methods for aquatic toxicity-identification evaluations. Phase 1 toxicity characterization procedures.** Mount, D.I.; Anderson-Carnahan, L. (Environmental Protection Agency, Duluth, MN (USA). Environmental Research Lab.). Sep 1988. 68p. (EPA—600/3-88/034). NTIS, PC A04/MF A01.

This manual describes procedures for characterizing the physical/chemical nature of toxicants in acutely toxic effluent samples. To detect the presence and potency of the toxicants as the sample is manipulated, the measurement of toxicity using organisms is helpful. The final step is to separate the toxicants from other sample constituents to simplify the analytical process. Usually the toxicants must be concentrated for analysis. Sample manipulations to alter toxicity include: sparging, pH change, filtration, solid-phase extraction and addition of chelating and reducing agents. The results will often reveal information about the physical/chemical characteristics of the toxicants.

13577 **(PB—89-125959/XAB) Proposed test protocol to determine toxicant leaching into potable water.** Rossi, R.; Turner, C.R.; Basu, D.K. (Syracuse Research Corp., NY (USA)). Nov 1988. 61p. NTIS, PC A04/MF A01.

Research was conducted to develop a general test protocol to identify the possible deterioration of water quality as a result of leaching of toxicants from distribution/transmission pipes and tanks during distribution and storage of potable water. The developed protocol was tested with a representative coating material normally used for corrosion inhibition of standard steel pipes and tanks and is known to contain a large number of compounds, some of which are suspected to be carcinogenic. The leaching apparatus of the test protocol is expected to be applicable in predicting possible toxicant leaching from other coated and uncoated materials that come in contact with potable water.

13578 **(PB—89-125983/XAB) National Stream Survey: phase 1. Quality assurance report.** Cougan, K.A.; Sutton, D.W.; Peck, D.V.; Miller, V.J.; Pollard, J.E. (Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV (USA)). Apr 1988. 222p. NTIS, PC A10/MF A01.

See also PB—88-245923.

The National Stream Survey - Phase I, conducted during the spring of 1986, was designed to assess quantitatively the present chemical status of streams in regions of the eastern United States where aquatic resources are potentially at risk as a result of acidic deposition. A quality-assurance program was implemented to ensure consistency in the collection and analysis of water samples and to verify the reported results. In addition, the quality assurance program provides data users with quantitative and qualitative documentation of the quality of the data base in terms of representativeness, completeness, and comparability and the quality of the analytical results in terms of detectability, accuracy, and precision. The quality assurance report describes the major design and operational aspects of the quality assurance program and the final assessment of the quality of the analytical problems that occurred during the survey and the corrective actions implemented.

13579 **(PB—89-126593/XAB) Qualitative pathogen risk assessment for ocean disposal of municipal sludge.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). May 1986. 141p. (EPA—600/6-88/010). NTIS, PC A07/MF A01.

The purpose of the document is to focus on microbial contaminants of municipal waste-water sludges that have been actually or potentially implicated in producing human illness; it summarizes available data on the occurrence, transport and fate of these pathogens in the marine environment; and describes the possible hazards to human health associated with the disposal of sludges in open ocean waters. Following the presentation of background information, a discussion of risks associated with ocean disposal of sludge are presented.

13580 **(PB—89-127799/XAB) Intensive survey of the Eagle Creek basin, Saline and Gallatin Counties, Illinois, 1986-1987.** Matson, M.R.; Hite, R.L. (Illinois Environmental Protection Agency, Springfield (USA). Div. of Water Pollution Control). Mar 1988. 48p. (IEPA/WPC—88-019). NTIS, PC A03/MF A01.

The Eagle Creek Watershed, south of Harrisburg in southern Illinois has historically been impacted from extensive coal-mining operations. Knowledge of the stream-quality problems caused by mining activities prompted designation of this stream as a priority water body in the 1982-1983 Illinois Water Quality Report (IEPA 1984). In late summer 1986, a stream quality investigation was initiated to determine the current status of Eagle Creek. Aquatic macroinvertebrate and water-quality samples were collected from eight locations in the Eagle Creek watershed; fish populations, stream habitat and sediment chemistry were assessed at selected basin sites (Appendix Table A). Objectives of this assessment were to: Document ambient water-quality conditions and any problems resulting from coal-mining activities in the basin; Evaluate biotic integrity in the basin using aquatic macroinvertebrate and fish communities; Determine aquatic-life use support attainment and factors causing or contributing to use impairment; Assign a Biological Stream Characterization (BSC) rating to stream segments assessed; and Determine sediment chemistry characteristics and document constituents present at abnormal levels.

13581 **(PB—89-127807/XAB) Intensive survey of the Sugar Creek Basin, Crawford County, Illinois, 1986.** Hite, R.L.; King, M.M.; Matson, M.R.; Bickers, C.A. (Illinois Environmental Protection Agency, Springfield (USA). Div. of Water Pollution Control). Jun 1988. 91p. (IEPA/WPC—88-030). NTIS, PC A05/MF A01.

An intensive survey of Sugar Creek and tributaries in the vicinity of Robinson, Illinois in Crawford County was conducted during the period June 24 to October 8, 1986. Sugar Creek, a tributary of the Wabash River, is 14 miles long and has a watershed of 69.5 square miles. Major dischargers in the basin include the Robinson municipal waste-water facility (MWWTP) and the Marathon Oil Company refinery; both discharged to Robinson Creek. The survey was designed primarily to assess waste-water impact from these two sources upon water quality and biotic integrity of the receiving streams. Environmental quality was summarized utilizing various indices including water quality (WQI), macroinvertebrates (MBI), fish (AIBI), and habitat (PIBI). Severe stream degradation evident in approximately 9.5 miles of Robinson and Sugar Creeks was attributed to wastewater from the Marathon Petroleum Company.

13582 **(PB—89-129399/XAB) EPA (Environmental Protection Agency) treatability data base.** Hansen, S.A.; Crosby, C.; Dostal, K.A. (Radian Corp., Milwaukee, WI (USA)). Nov 1988. 15p. NTIS, PC A03/MF A01.

Since the mid-1970's EPA has generated a wealth of data on the treatability of organic and inorganic compounds found in industrial and domestic waste waters, groundwater, leachates, and surface waters. To date, various attempts have been made to organize selected segments of this information, but a comprehensive evaluation and compilation of information encompassing compounds regulated by all pertinent environmental laws has not been undertaken. The major activity was initiated with the overall objective of providing a data base on the treatability of priority pollutants and other hazardous compounds in water and waste water. The data base summarizes years of studies on the treatability of priority pollutants and other hazardous compounds.

13583 **(PB—89-852131/XAB) Heavy metals in drinking water: standards, sources, and effects. January 1977-December 1988 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 128p. NTIS PC N01/MF N01.

Supersedes PB—88-856547.

This bibliography contains citations concerning the public-health aspects and documented studies of heavy-metal pollutants in drinking water. Topics include human exposure studies and the toxicological effects incurred by ingestion of lead, copper, nickel, mercury, cadmium, manganese, and zinc. Prolonged exposure and quantification factors and effects, federal and state regulations and standards, and laboratory animal studies are discussed. Sources from landfill contamination of ground water, acid-precipitation contributions to ground water pollution, and corrosion by-products in residential plumbing and public-water-supply transport systems are examined. (This updated bibliography contains 201 citations, 62 of which are new entries to the previous edition.)

13584 **(PB—89-852453/XAB) Ground water: volatile organic compounds (VOC's). January 1970-December 1988 (Citations from the NTIS data base). Report for January 1970-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 115p. NTIS PC N01/MF N01.

This bibliography contains citations concerning volatile organic compounds (VOC's) in ground water. Articles cover the detection, identification, and quantification of VOC's in ground water. Detection methods are covered as well as means for following the spread of the compounds. Citations also cover the removal of volatile organic compounds from groundwater. Superfund decisions, environmental impact statements, and reports of the Installation Restoration Program undertaken by the military are included. (Contains 161 citations fully indexed and including a title list.)

13585 **(PNL—6754) Compilation, evaluation, and prediction of triple-layer model constants for ions on Fe(III) and Mn(IV) hydrous oxides.** Smith, R.W.; Jenne, E.A. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 56p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005510/JAW.

This report includes recommendations for further work. A brief discussion of the formulation of the Triple Layer Model (TLM) of the oxide/water interfaces is given in Section 3. Table of literature values for TLM constants are given in Section 4.0. In addition, the sources of uncertainties in the TLM constants are discussed. Equations useful for the prediction of TLM parameters are presented in Section 6.0. Summaries of experimental conditions used by the various investigators referenced in this report are given in Appendix A. 43 refs., 4 figs., 12 tabs. (JL)

13586 **(PNL—6792) Confirmatory chemical analyses and solid phase bioassays on sediment from the Columbia River Estuary at Tongue Point, Oregon.** Young, J.S.; Word, J.Q.; Apts, C.W.; Barrows, M.E.; Cullinan, V.I.; Kohn, N.P. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 76p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005679/JAW.

The Department of Economic Development, Ports Division, of the state of Oregon plans to develop a former ship supply and storage site near Tongue Point, Oregon, for commercial shipping. The development would require dredging the adjacent waterway to the Columbia River 40-foot channel to admit commercials vessels. The Portland District of the US Army Corps of Engineers requested the Battelle/Marine Sciences Laboratory (MSL) to conduct confirmatory solid-phase bioassays that would provide technical data for an evaluation of the potential environmental impact of ocean disposal of the dredged material. These confirmatory studies provided chemical and biological information required by ocean dumping regulations to determine suitability of Tongue Point sediments for ocean disposal. Sediment core samples were collected from Cathlamet Bay at Tongue Point in the upper Columbia River estuary. Sediment surface grab samples were collected at reference/control sites offshore from the mouth of the Columbia River (Disposal Site F) and at West Beach, Whidbey Island, Washington. The Tongue Point sediments were mixed into two composited batches. The MSL conducted solid-phase bioassays with these composites and reference sediments on four species of organisms.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 12677, 12689, 12700, 12710, 12898, 13239, 13535, 13536, 13552, 13554, 13707

13587 **(CNIC—00067) Study on environmental background values of uranium in water of Dongting Lake system.** Zhai Pengji; Kang Tiesheng. (Academia Sinica, Beijing, BJ (China). Inst. of High Energy Physics). (China Nuclear Information Centre, Beijing, BJ). 1987. 16p. (In Chinese). (AS-IHP—0004). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705030/JAW.

Study on environmental background values in water is the base of evaluating water quality and also is the foundational work of studying the law of distribution, accumulation and transfer of the elements. Research on background values of U in water not only can understand radioactive level but also has actual significance for the general survey of U by water. In the work uranium contents were determined by fission track analytical technique in the filtered and unfiltered specimens of river water, reservoir water and spring water taken from more than one hundred sections located in Dongting Lake system and the statistical process of data were carried out by computer. The environmental background values in water of various river system were obtained and compared with the situation of home and abroad. The seasonal variety of uranium content and the level of U in reservoir, spring water and natural reserve were discussed.

13588 **(CNIC—00151) Radioactive levels in Taihu and water bodies of Suzhou.** Zhang Zhonghou; Fu Rongchu; Zhu Nankang; Wang Huiyu; Hu Qiyao. (Suzhou Medical Coll., JS (China)). (China Nuclear Information Centre, Beijing, BJ). Jan 1988. 9p. (In Chinese). (SMC—0019). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705060/JAW.

The radioactive levels in Taihu and water bodies of Suzhou, southern China, were investigated in 1983. The results of the investigation were compared with that of 1973. In addition, the authors investigated a suspected radioactive pollutant-ash of coal powder from Wongting coal-fired power plant and its affect on the water in Taihu and Suzhou section of the Grand Canal. These results show: the average radioactive levels in Taihu are 41.4 mBq/L for total α, 91.9 mBq/L for total β, 3.4 x 10/sup -7/ g/L for uranium, 3.5 x 10/sup -7/ g/L for thorium; in Suzhou section of the Grand Canal 37.6 mBq/L for total α, 101.9 mBq/L for total β, 3.6 x 10/sup -7/ g/L for uranium, 4.9 x 10/sup -7/ g/L for thorium; in shallow well of Suzhou 61.4 mBq/L for total α, 857.7 mBq/L for total β, 1.6 x 10/sup -7/ g/L for uranium, 3.9 x 10/sup -7/ g/L for thorium. The radioactive levels in dry season are higher than that in rainy season, and each of them is lower than that in 1973. The average radioactive levels in Taihu and in Suzhou section of the Grand Canal caused by ash of coal powder from Wongting coal-fired power plant are: 87.3 and 140.6 mBq/L for total α respectively; 146.3 and 162.8 mBq/L for total β; 162.0 and 130.2 mBq/L for /sup 40/K; 6.7 x 10/sup -7/ and 5.3 x 10/sup -7/ g/L for uranium and 4.1 x 10/sup -7/ and 4.6 x 10/sup -7/ g/L for thorium.

13589 **(DOE-RW—88,074) Comparison of thermodynamic databases used in geochemical modelling.** Chandratillake, M.R.; Newton, G.W.A.; Robinson, V.J. (Manchester Univ. (UK). Dept. of Chemistry). (Department of the Environment, London (UK)). May 1988. 76p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755548/JAW.

Four thermodynamic databases used by European groups for geochemical modelling have been compared. Thermodynamic data for both aqueous species and solid species have been listed. When the values are directly comparable any differences between them have been highlighted at two levels of significance.

13590 **(INIS-mf—11336) Numerical simulation studies of the groundwater discharge to streams from abandoned uranium mill tailings.** Abdul, A.S.; Gillham, R.W. (Waterloo Univ., Ontario (Canada). Dept. of Earth Sciences). (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Jun 1984. 35p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705193/JAW.

Prepared for the National Uranium Tailings Program.

This report presents an evaluation of the results of simulation studies of groundwater discharge to streams from abandoned uranium mill tailings and the effects of this discharge on the flux of contaminants to surface water systems. In particular, a discussion of the sensitivity of subsurface discharge to specific geometirc, climatic and hydrogeologic factors is presented. Simulations were carried out using a two-dimensional numerical finite-element unsaturated-saturated flow model. A total of twenty-six simulations were made. The first twenty-four of these considered a tailings medium with homogeneous and isotropic hydraulic properties and with textural properties similar to those of sandy geological materials. In addition, two simulations were carried out for tailings materials with hydraulic properties that are similar to those of silt-loam. The results indicated that the actual quantity of subsurface discharge depends on many factors including rainfall rate and duration, surface slope, and texture. However, for the medium-fine sand material, subsurface discharge was always a significant component of the total discharge. Within the context of uranium tailings management this implies that large quantities of contaminants from subsurface sources of medium-textured tailings can be expected to be discharged to streams during stormflow events. Therefore there is reason to suspect that untreated runoff from such tailings will contain significant concentrations of contaminants for long periods of time.

13591 **(INIS-mf—11337) Modelling of contaminant migration in acidic groundwater plumes at uranium tailings impoundments: ADNEUT3.** Cherry, J.A.; Morin, K.A.; Dubrovsky, N.M. (Waterloo Univ., Ontario (Canada). Dept. of Earth Sciences). (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Jun 1984. 110p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705194/JAW.

Prepared for the National Uranium Tailings Program.

This report describes the creation and application of ADNEUT3, the latest addition to the ADNEUT (Acid-Drainage NEUTralization) family of computer programs for simulating acid-drainage transport and neutralization. The creation of ADNEUT3 involved the expansion of ADNEUT1 to allow variable input conditions such as changing input solution with time, variable initial amounts of minerals through the simulated streamtube, variable velocities through the streamtube, and variable solubilities for relevant minerals dependent on aqueous chemical composition. Concepts for simulating acid-drainage neutralization are reviewed and ADNEUT3 is then applied to a field-study site of acidic contaminant migration from the Nordic Main uranium-tailings impoundment near Elliot Lake, Ontario. A sensitivity study is first implemented to calibrate ADNEUT3 to the results of the 1979 to 1983 field studies. Then ADNEUT3 is used to define probable past conditions at the site which are not reliably known. In particular, ADNEUT3 is used to help identify: (1) the approximate year when acidic seepage began leaving the tailings impoundment (1966-1967), (2) the past chemical composition of the seepage (somewhat more acidic for a short period of time), and (3) the location of the source area within the tailings for the acidic seepage (near the impoundment dam, close to the field site). Finally, ADNEUT3 is used to predict future contaminant migration. Results indicate that hundreds of years are required under present conditions for the most acidic water with associated high levels of contaminants to migrate about 100 m from the tailings impoundment. The cause of this slow movement is the significant neutralization capacity of the aquifer. If acid production within the tailings decreases in the future, migration rates of contaminants will also decrease.

13592 **(MAFF-FRDR—14) Current meter observations near the Sellafield pipeline, 1984-1986.** Jones, S.R.; Norris, S. (Ministry of Agriculture, Fisheries and Food, Lowestoft (UK). Directorate of Fisheries Research). 1988. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705207/JAW.

Low-level liquid radioactive wastes are discharged into the north-east Irish Sea, under authorization, from the Sellafield reprocessing plant run by British Nuclear Fuels (BNFL). The effluent contains a range of radionuclides including caesium-137. The discharges are monitored and assessed by the Aquatic Environment Protection Division which is part of the Ministry of agriculture, Food and Fisheries. The results from the Sellafield current meter mooring in the Irish Sea from December 1983 to December 1986 are presented. The aim was to assess long-term tidal and residual current conditions under a variety of wind and current combinations as part of the assessment of the distribution of discharged radionuclides. The instrumentation is described briefly. Periods of data loss (due to meter failure or loss) and the data processing are explained. The results of the current metering are presented. (U.K.).

13593 **(PNL—6795) Assessment of aquatic organisms as bioindicators of historical radionuclide release to the Columbia River.** Dauble, D.D.; Poston, T.M.; Newell, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 30p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005941/JAW.

This study examined the potential for using several aquatic organisms as biological indicators of historic levels of radionuclides released to the Hanford Reach of the Columbia River. The purpose of the study was to determine the types of environmental samples that could be collected to further our understanding of previous releases of radionuclides at Hanford. Information was initially collected to determine the relative abundance and persistence of radionuclides historically released at Hanford. The potential for long-lived radionuclides to bioaccumulated in aquatic organisms was then assessed. The life history of several common aquatic organisms was examined to evaluate their use as potential bioindicators of radionuclides released to the Columbia River. Considerations for analyzing strontium (^{90}Sr) in biological samples were determined. Based on our review of radionuclides released to the environment and their potential for bioaccumulation in aquatic organisms, strontium appears to be the only radionuclide suitable for further study. White sturgeon (Acipenser transmontanus) and the common mussel (Margaritifera margaritifera) are suitable candidates for developing dose reconstruction scenarios. Considerations for tissue analysis of radionuclide concentration in these species include potential for biological turnover and tissue mass. 48 refs., 1 fig., 4 tabs.

5204 Thermal Effluents Monitoring And Transport

13594 **(SNV—3397) Macrofauna on rocky substrates in the Forsmark biotest basin. March 1984 - March 1985.** Snoeijs, P.; Mo, K. (Vaextbiologiska Institutionen, Uppsala (Sweden); Statens Naturvaardsverket, Uppsala (Sweden). Miljoekontrollaboratoriet). (National Swedish Environmental Protection Board, Solna). Sep 1987. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756535/JAW.

The Forsmark biotest basin, situated on the Swedish east coast, is an artificial offshore brackish lake, through which the cooling water is channelled from the Forsmark nuclear power plant to the Bothnian Sea. The biotest basin is up to 10/sup 0/C warmer than the sea surrounding it, and has no ice cover in winter. There is an artificial, fast current in a large part of the basin. Macrofauna on stones in the hydrolittoral belt was sampled at 11 sites in- and outside the basin every third week during one year. The numbers of individuals per m/sup 2/ for each taxon were counted. Diversity indices and dominance-diversity curves were computed for each site on the basis of pooled data for the cold season, and for the rest of the year. In total 66 taxa were distinguished in the species lists, of which 3 are sessile, the rest free-living.

5205 Site Resource And Use Studies

13595 **(PB—89-852412/XAB) Artificial recharge of aquifers. January 1977-December 1988 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 227p. NTIS PC N01/MF N01.

Supersedes PB—88-856042.

This bibliography contains citations concerning the utilization of artificial recharge methods to improve water availability and water quality. Topics include site-studies and evaluation, the use of impounded fresh water and treated waste water, the role of artificial recharge techniques in ground-water resource management, individual state programs, contaminant behavior, and the engineering aspects of utilizing spreading ponds and injection wells. Legal and environmental considerations and the use of computer simulations are also treated. (This updated bibliography contains 368 citations, 43 of which are new entries to the previous edition.)

13596 **(PNL—6794) Confirmatory sediment analyses and solid and suspended particulate phase bioassays on sediment from Oakland Inner Harbor, San Francisco, California.** Word, J.Q.; Ward, J.A.; Apts, C.W.; Woodruff, D.L.; Barrows, M.E.; Cullinan, V.I.; Hyland, J.L.; Campbell, J.F. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 262p. NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005969/JAW.

The US Army Corps of Engineers (USACE), San Francisco District, was authorized by the US Congress to deepen the navigation channels of Inner and Outer Oakland Harbor, California. During review of the environmental impact statement required for this dredging and disposal project, a panel of national experts approved the open-water disposal of dredged sediment from selected areas within the Inner Harbor, subject to results of confirmatory solid phase bioassays. The San Francisco District of the Corps requested the Battle/Marine Sciences Laboratory (MSL) to conduct these confirmatory studies. The studies provided technical data for an evaluation of the potential environmental impact of this project. Within extremely narrow time constraints, these studies provided chemical and biological information required by ocean dumping regulations to determine suitability of the Oakland Inner Harbor and turning basin sediment for ocean disposal. 23 refs., 18 figs., 45 tabs.

5206 Regulations

REFER ALSO TO CITATION(S) 13660, 13661, 13662, 13663, 13664, 13665

13597 **(AD-A—200177/4/XAB) New Bedford Harbor Superfund Project, Acushnet River estuary engineering feasibility study of dredging and dredged material disposal alternatives. Report 4. Surface runoff quality evaluation for confined disposal. Technical report, June-February 1987.** Skogerboe, J.G.; Price, R.A.; Brandon, D.L. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab.). Oct 1988. 24p. (WES/TR/EL—88-15-4). NTIS, PC A03/MF A01.

See also Report 6, AD-A200 177.

The thickness of capping material needed to chemically sequests the polychlorinated biphenyl (PCB)-contaminated New Bedford Harbor sediment from the overlying water column and aquatic biota was assessed in a small-scale predictive test. Changes in the overlying water concentrations of dissolved oxygen, ammonium-nitrogen, and orthophosphate-phosphorus were monitored following isolation of the water column from the atmosphere by placing a 4-cm layer of mineral oil on the water surface. The chemical tracers (ammonium-nitrogen and orthophosphate-phosphorus) were selected for their mobility under anaerobic conditions, ease of measurement, and generally high concentrations in contaminated dredged material compared with clean sediments. The chemical tracers were used to evaluate the efficiency of the capping material in preventing transfer of contaminants from New Bedford Harbor sediment into the overlying water column.

13598 **(AD-A—200178/2/XAB) New Bedford Harbor Superfund Project, Acushnet River estuary engineering feasibility study of dredging and dredged-material disposal alternatives. Report 1. Study overview. Technical report, August 1985-March 1988.** Francingues, N.R.; Averett, D.E.; Otis, M.J. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab.). Oct 1988. 35p. (WES/TR/EL—88-15-1). NTIS, PC A03/MF A01.

See also Report 4, AD-A200 462.

Sediments in the New Bedford Harbor and Acushnet River Estuary have been contaminated with polychlorinated biphenyl compounds and heavy metals. The high levels of contamination have resulted in the New Bedford Harbor being placed on the National Priorities List of the Nation's worst hazardous waste sites. Efforts are under way to develop and implement remedial actions for protection of the environment under the Federal Superfund Program. This report is an introduction to and an overview of a series of reports describing the results of the EFS. It presents the overall study objectives and scope of work, describes the objectives and scope of the 10 EFS tasks, and presents a brief synopsis of the other 11 reports in the series. The EFS technical approach used field data-collection activities, literature reviews, laboratory (bench-scale) studies, and analytical and numerical modeling techniques to assess engineering feasibility and develop conceptual alternatives for dredging and dredged-material disposal. Technical and engineering issues addressed by the EFS included baseline mapping, geotechnical investigations, hydrodynamics, sediment resuspension and transport, contaminant releases to surface and ground water, dredged material settling properties, dredging equipment and controls, effluent treatment, solidification/stabilization of dredged material, confined-disposal-facility design, contained aquatic-disposal-facility design, and cost estimates for the alternatives evaluated.

13599 **(AD-A—200193/1/XAB) Repair, Evaluation, Maintenance, and Rehabilitation Research Program. Compliance requirements for environmental laws applicable to REMR activities. Final report.** Henderson, J.E.; Peyman-Dove, L.D. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA)). Aug 1988. 89p. (WES/TR/REMR-EI—3). NTIS, PC A05/MF A01.

Operation and maintenance (O&M) activities of the Corps of Engineers must comply with the environmental laws and regulations just as other Corps activities and private actions. The O&M procedures developed under the Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Research Program might result in water pollution, use or disposal of hazardous or toxic materials, or other actions that are regulated by environmental laws. A previous review of environmental laws for applicability to REMR activities identified 14 laws, regulations, or executive orders that may require compliance actions (Technical Report REMR-EI-1).

13600 **(PB—89-125405/XAB) Ground-water-monitoring evaluation, Hughes Aircraft, US Air Force Plant No. 44. Tucson, Arizona.** Filippini, M.G.; Zuroski, D. (Environmental Protection Agency, San Francisco, CA (USA)). Apr 1988. 84p. (EPA—700/8-87/037). NTIS, PC A05/MF A01.

This report summarizes the results of EPA investigations conducted during April 1987 at the Hughes Aircraft/Air Force Plant 44 in Tucson, Arizona to determine compliance with the regulatory requirements of ground-water monitoring, and for the hazardous and solid-waste amendments of RCRA, and the corresponding State regulations. Based on the results of these investigations, a number of requisite actions were identified to attain compliance.

13601 **(PB—89-128334/XAB) Superfund record of decision (EPA Region 6): Odessa Chromium 1, Texas, March 1988. Second remedial action. Final report.** (Environmental Protection Agency, Washington, DC (USA)). 18 Mar 1988. 90p. (EPA/ROD/R—06-88/026). NTIS, PC A05/MF A01.

See also PB—89-128342 and PB—87-188462. Portions of this document are not fully legible.

This article is a Superfund record of decision. The Odessa Chromium I site consists of a series of chromium-contaminated wells within 300 acres. The article describes the situation of pollu-

tion in the wells and ground water in the area due to plating, the selected remedial action, and estimated cost.

13602 **(PB—89-128342/XAB) Superfund record of decision (EPA Region 6): Odessa Chromium 2, Texas, March 1988. Second remedial action. Final report.** (Environmental Protection Agency, Washington, DC (USA)). 18 Mar 1988. 81p. (EPA/ROD/R—06-88/027). NTIS, PC A05/MF A01.
See also PB—89-128334 and PB—87-189916.

This article is a Superfund record of decision. The Odessa Chromium II site consists of a series of chromium-contaminated wells within 200 areas. The article describes the situation of pollution in the wells and ground water in the area due to utilizing chromium in the cooling system, the selected remedial action, and estimated cost.

13603 **(PB—89-128359/XAB) Superfund record of decision (EPA Region 6): Old Midland Products, Arkansas, March 1988. First remedial action.** (Environmental Protection Agency, Washington, DC (USA)). 24 Mar 1988. 39p. (EPA/ROD/R—06-88/028). NTIS, PC A03/MF A01.

Between 1969 and 1970, Old Midland Products was in operation treating wood with creosote. Effluents containing pentachlorophenol (PCP) and polynuclear aromatic compounds were discharged into lagoons via a moveable discharge pipe. Approximately 9,000 to 21,000 cu yd of soil, 850 cu yd of drainage sediments, 450,000 gallons of ground water, 620,000 gallons of lagoon fluids, and 2,770 cu yd of lagoon sludges are contaminated with PCP and polynuclear aromatic hydrocarbons. The selected remedial action for this site includes: onsite thermal destruction of the contaminated surface soils, lagoon sludges, and drainageway sediments with onsite disposal of waste residuals and a vegetated cover; and ground water pump and treatment using carbon adsorption. Cost estimates for these actions have not yet been fully developed and recovery enforcement action will be pursued at a later date.

53 Social And Economic Studies

REFER ALSO TO CITATION(S) 13006, 13008

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 13616, 13623

13604 **(DOE/ER/13109—T2) Osmotin: A protein associated with osmotic stress adaptation in plant cells: Final report, September 1, 1983--August 31, 1988.** Bressan, R.A. (Purdue Univ., Lafayette, IN (USA)). Dec 1988. Contract AC02-83ER13109. 22p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005636/JAW.

Osmotin is a cationic protein which accumulates (up to 12% of total cell protein) in cells adapted to grow in the medium with low water potentials. The synthesis of osmotin is developmentally regulated and is induced by abscisic acid (ABA) in cultured cells. In whole plants, both the synthesis and accumulation of osmotin is tissue specific. The highest rate of synthesis occurs in outer stem tissue and the highest level of accumulation occurs in roots. ABA induced synthesis of osmotin is transient in cells and NaCl stabilizes its synthesis and accumulation. NaCl adapted tobacco cells exhibit a stable increase in both their ability to tolerate salt and to produce osmotin in the absence of NaCl. Osmotin is localized in vacuolar inclusions, but also appears to be loosely associated with the tonoplast and plasma membrane. Osmotin is also found in the culture medium of adapted cells during all stages of cell growth. The molecular weight of mature osmotin deduced from the cDNA nucleotide sequence is 23,984 daltons. Osmotin is synthesized as a preprotein 2.5 kD larger than the mature protein. Three proteins, thaumatin, TPR and MAI, exhibit a very high level (52% to 61%) of sequence homology with osmotin. Osmotin mRNA synthesis is induced by ABA. The level of osmotin mRNA increases after NaCl adaptation. 34 refs., 11 figs.

13605 **(DOE/ER/13371—1-Vol.4) Current topics in plant biochemistry and physiology: Volume 4: Proceedings.** Randall, D.D.; Blevins, D.G.; Larson, R.L. (eds.). (Missouri Univ., Columbia (USA)). 1985. Contract FG02-85ER13371. 265p. (CONF-8504338—). NTIS, PC A12 - OSTI. Order Number DE89003078/JAW.

From 4. annual plant biochemistry and physiology symposium; Columbia, MO, USA (10 Apr 1985).

These proceedings represent papers presented at the Fourth Annual Plant Biochemistry and Physiology Symposium held at the University of Missouri-Columbia, April 10-12, 1985 and hosted by the Interdisciplinary Plant Biochemistry and Physiology Group. This Interdisciplinary Group was organized to facilitate research and training through interdisciplinary and cooperative approaches to problems facing Plant Biochemistry and Physiology. A key objective of this group is to maintain an awareness of the advances in research in this field. This annual symposium is one means of meeting this objective. Topics are selected each year in three to five areas in order to broaden our individual horizons.

13606 **(DOE/ER/13371—1-Vol.6) Current topics in plant biochemistry and physiology: Volume 6.** Randall, D.D.; Sharp, R.E.; Novacky, A.J.; Blevins, D.G. (eds.). (Missouri Univ., Columbia (USA)). 1987. Contract FG02-85ER13371. 190p. (CONF-8704340—). NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number TI89003080/JAW.

From 6. annual plant biochemistry and physiology symposium; Columbia, MO, USA (1 Apr 1987).

These proceedings represent papers presented at the Sixth Annual Plant Biochemistry and Physiology Symposium held at the University of Missouri-Columbia, April 1-3, 1987 and hosted by the Interdisciplinary Plant Biochemistry and Physiology Group. The Interdisciplinary Plant Group was organized to facilitate research and training through interdisciplinary and cooperative approaches to problems facing Plant Biochemistry and Physiology. This annual Symposium is a means of maintaining an awareness of the advances in pertinent research areas.

13607 **(DOE/ER/13425—2) Studies on oligosaccharins, carbohydrates possessing biological regulatory activities: Technical progress report for the period 9/87--9/88.** Albersheim, P. (Georgia Univ., Athens (USA). Complex Carbohydrate Research Center). Sep 1988. Contract FG09-85ER13425. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005909/JAW.

Complex carbohydrates have long been known to play important roles in biological recognition. In recent years it has been determined that complex carbohydrates are chemical messengers, that is, they act as regulatory molecules in plants and animals. This grant proposal concerns the characterization of such carbohydrate-regulatory molecules that are active in plant tissues. for example, we have shown that oligosaccharide fragments of major structural polysaccharides of fungal and plant cell walls can elicit plant cells to accumulate phytoalexins (antibiotics), a plant response that appears to be a general defense mechanism against potential pathogens. The enzymes that are catalyzed for synthesis of phytoalexins are themselves synthesized de novo in response to these carbohydrate-regulatory molecules. We call naturally occurring cell wall carbohydrates, with biological regulatory functions, oligosaccharins. It appears that the oligosaccharins involved in the elicitation of phytoalexin accumulation in plants are examples of a wide variety of oligosaccharins with diverse activities. Our laboratory is making a major effort to extend the oligosaccharin hypothesis to other areas of the interactions between plants and microbes, and also to the control of plant growth and development. We describe below our progress and proposed research in the oligosaccharin project. Our proposed research is a continuation of that described in our original proposal. 10 refs.

13608 **(DOE/ER/13426—2) Structural studies of complex carbohydrates of plant cell walls: Technical progress report for the period September 1987--September 1988.** Darvill, A. (Georgia Univ., Athens (USA). Complex Carbohydrate Research Center). Sep 1988. Contract FG09-85ER13426. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005911/JAW.

Characterizing the polysaccharides that constitute the primary cell walls of plants has been a major research goal of our laboratory for many years. Our experience and the vastly improved technologies used to study these polysaccharides have resulted in a steadily increasing rate at which we are acquiring structural knowledge of the cell wall. We have recently completed projects that have identified the major structural features of the pectic polysaccharide rhamnogalacturonan I in monocots and in describing the rhamnogalacturonan I family found in dicot tissues. We have also made considerable progress toward elucidating the structure of the pectic polysaccharide rhamnogalacturonan II isolated from sycamore cell walls and completed the identification of 3-deoxy-D-lyxo-2-heptulosaric acids, a component of rhamnogalacturonan II. We have also recently completed studies on the comparison of the O-acetylation pattern of xyloglucans isolated from sycamore cell walls and xyloglucans isolated from the extracellular medium of sycamore cells grown in culture. Finally, we have completed work comparing various methods of preparing cell walls in order to optimize the yield of cell wall fractions solubilized by chemical extraction procedures. However, in spite of this substantial progress, we remain far from defining the complete primary structures of the noncellulosic polysaccharides of cell walls. 8 figs.

13609 **(DOE/ER/13883—1) Unravelling lignin formation and structure in living plants: Progress report January 1--November 24, 1988.** Lewis, N.G. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Forest Products). 1988. Contract FG05-88ER13883. 11p. NTIS, PC A03 - OSTI. Order Number DE89005066/JAW.

Objectives for the study are given below: (1) determination of bonding patterns of lignin in situ; (2) function of specific peroxidase isozymes in lignin formation; (3) role of cell wall bound hydroxycinnamic acids in lignin biosynthesis; (4) isolation of hemicellulose hydroxycinnamic acid ester transferase; (5) transport of precursors to site of lignification; (6) biosynthesis of 1-0-glucosides of Z-monolignols; (7) E/Z isomerization of hydroxycinnamyl alcohols. Results are presented. 16 refs., 1 fig.

13610 **(DOE/ER/60690—1) Novel methods for physical mapping of the human genome applied to the long arm of chromosome 5: Progress report for the period June 1, 1988 to October 1, 1988.** McClelland, M.; Westbrook, C. (Illinois Univ., Chicago (USA)). Oct 1988. Contract FG02-88ER60690. 4p. NTIS, PC A04 - OSTI. Order Number DE89005820/JAW.

The linkage of two genes IL-4 and IL-5 has been determined in the region of interest. These genes lie within 310,000 base pairs of each other, as determined by PFE. This is a contribution to our long term goal of producing a detailed physical map of this region. We have reduced to practice two methylase/DpnI strategies, with the specificities TCGATCGA and ATCGATCGAT. In addition, we have determined that cloned M.Xbal methylates the correct TCTAG/sup m6/A sequence for use in a new twelve base pair TCTAGATCTAGA cleavage specificity. These cleavage systems are being applied to a somatic cell hybrid that contains part of human 5q.

13611 **(DOE/FTR—9004953) [Structure of the photosynthetic bacterial reaction center: X-ray crystallography and optical spectroscopy with polarized light, Centre d'Etudes Nucleaires, Cadarache, France, September 18--October 3, 1987]: Foreign trip report.** Hanson, L.K. (Brookhaven National Lab., Upton, NY (USA)). 14 Oct 1987. Contract AC02-76CH00016. 67p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004953/JAW.

This international workshop examined the latest advances in the structural, spectroscopic, and theoretical properties of reaction centers from photosynthetic bacteria. The recent structures of two reaction centers has opened up to detailed exploration the factors that govern charge separation and electron transfer in these systems.

13612 **(DOE/FTR—9005074) [Biophysics research problems: Collaboration with Australian Nuclear Science and Technology Organization, Commonwealth Scientific and Industrial Research Organization, and the Universities of Sydney and New South Wales, January 16--February 19, 1988]: Foreign trip report.** Schoenborn, B.P. (Brookhaven National Lab., Upton, NY (USA)). 15 Mar 1988. Contract AC02-76CH00016. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005074/JAW.

Over 900 participants gathered in Sydney for the Bicentenary Congress of Physics and approximately 100 participants attended the Biophysics Meeting. The Congress covered all aspects of physics with parallel sessions in nuclear physics, particle physics, medical physics, solid state physics, acoustics, optics, astrophysics and gaseous electronics. The continuing collaborative research efforts involve the neutron diffraction studies of cyclosporin and plastocyanin, as well as membrane studies with ubiquinone and gramicidin A. A seminar on neutron scattering was given in the Chemistry Department at the Australian National University which is interested in extending its scientific program to include protein crystallography and expand its small angle program.

13613 **(Juel—2175) Antibodies against membrane proteins of the cephalopode visual membrane for the investigation of transduction processes of the evertebrate light perceptive cell.** Conen, H. (Technische Hochschule Aachen (Germany, F.R.)). Jan 1988. 85p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756399/JAW.

In invertebrate photoreceptors signal transduction is not as well investigated as in bovine rod outer segments (Stryer, 1989). The initial event in both vertebrate and invertebrate photoreceptors is the photoisomerisation of the chromophor of the photopigment rhodopsin. There is circumstantial evidence for a G-protein being the target enzyme for the active metarhodopsin: There is an intrinsic GTPase activity that is induced by blue and suppressed by red illumination in musca eyes (Blumenfeld et al, 1986) and also a light-dark difference in GTPAase activity in squid photoreceptors (Saibil and Michel-Villaz, 1984). Blumenfeld et al. (1986) showd that the light activated GTPase activity in fly (musca) photoreceptors is assoziated with a long lasting excited state of metarhodopsin. This metarhodopsin seems also to be responsible for a prolonged depolarizing after potential in fly photoreceptors (Hamdorf and Razmjoo, 1977 and 1979/Hamdorf, 1979). Injections of GDP-β-S, a poorly hydrolysable analogues of GDP into the ventral photoreceptor of Limulus depress the sensitivity of the cells to light (Bolsover and Brown, 1982).

13614 **(UCRL—100076) Use of an antikinetochore antibody and DNA probes to measure aneuploidy induction in interphase human lymphocytes and Chinese hamster ovary cells.** Eastmond, D.A.; Tucker, J.D.; Pinkel, D. (Lawrence Livermore National Lab., CA (USA)). 5 Dec 1988. Contract W-7405-ENG-48. 15p. (CONF-8810209—10). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005638/JAW.

From 27. Hanford life sciences symposium on health and the environment; Richland, WA, USA (18 Oct 1988).

Aneuploidy in germ cells is associated with birth defects, spontaneous abortions, and infertility, whereas in somatic cells aneuploidy may lead to cell death and carcinogenesis. The nonrandom numerical chromosomal changes that are often observed in tumors or transformed cells suggest that aneuploidy induction by chemicals may be involved in carcinogenesis. The identification of aneuploidy inducing agents (aneuploidogens) and studies into the mechanisms by which aneuploidy may be involved in carcinogenesis are currently limited in that standard cytogenetic techniques are time consuming, require highly skilled personnel and are prone to technical artifacts. Recent developments in immunology and molecular biology have resulted in new techniques which may allow simple and rapid identification of aneuploidogens. We report the development of two new approaches to determine the aneuploidy-inducing potential of chemicals. The first approach involves the induction of micronuclei in human lymphocytes and Chinese hamster

ovary (CHO) cells and the use of an antikinetochore antibody to determine whether micronuclei contain centromeres---a condition indicating potential aneuploidy. The second approach involves the use of in situ hybridization with fluorescently labeled chromosome-specific DNA probes and the subsequent counting of the number of copies of that chromosome in the interphase nuclei of human lymphocytes. 8 refs., 1 fig., 1 tab.

5503 Cytology

REFER ALSO TO CITATION(S) 13515, 13605, 13606

5504 Genetics

REFER ALSO TO CITATION(S) 12751, 13605, 13606, 13610, 13625, 13666

13615 **(AD-A—199682/6/XAB) Determination of the structural basis of antibody diversity using NMR (nuclear magnetic resonance). Annual report, June 1986-June 1988.** McConnell, H.M. (Stanford Univ., CA (USA)). 15 Sep 1988. 19p. NTIS, PC A03/MF A01.

The combination of nuclear magnetic resonance (NMR) spectroscopy, recombinant DNA techniques and theoretical semiempirical model building appears to be a powerful approach to the protein engineering of antibody combining sites, for the ultimate production of antibodies having desired specificities and functions. In the past year the author has sequenced the cDNA's of 12 monoclonal anti-spin-label antibodies, has constructed a working model for one of these antibodies (M. Levitt), and has carried out a number of NMR experiments that have tested this model, and has provided kinetic data on hapten antibody binding. In the next year crucial tests of this model, the NMR assignments, and this general approach to protein engineering will be made by transfection/expression experimentation involving specific mutations of the antibody genes for the antibodies ANO1-AN12.

13616 **(PB—88-162805) Mapping our genes: Federal genome projects: How vast? How fast? Contractor reports, Volume 2.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Feb 1988. 217p. NTIS, PC A10/MF A01 - OSTI. Order Number TI88010822/JAW.

Contractor reports solicited by the Office of Technology Assessment in preparing a briefing report and recommendations to congress on the Federal Role in human genetic mapping are provided. The five reports in this volume are entitled - The mapping and sequencing of genomes: A comparative analysis of methods, benefits and disbenefits; Mapping the human genome: Experimental approaches for cloning and ordering DNA fragments; Mapping and sequencing the human genome in Europe; Application of human genome mapping for the global control of genetic disease; and In search of the ultimate map of the human genome: The Japanese efforts. Each of these reports have been separately indexed and abstracted for the Energy Data Base. (DT)

5505 Metabolism

REFER ALSO TO CITATION(S) 12512, 13545

5506 Medicine

REFER ALSO TO CITATION(S) 12996, 13637

13617 **(DOE/ER/13710—2) [Cellular energy metabolism]: Progress report.** Glaser, M. (Illinois Univ., Urbana (USA). Dept. of Biochemistry). [1989]. Contract FG02-87ER13710. 2p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005721/JAW.

The overall objectives of this research are to determine the structure and dynamic properties of adenylate kinase and to understand its role in regulating the concentrations of adenine nucleotides and the energy status of the cell. Research has continued on the four specific aims given in the original research application. The first specific aim was to isolate adenylate kinase from wild type and mutant strains of E. coli. The second specific aim involves using the cloned gene to vary the level of adenylate kinase in the cell in order to determine the effects on cell metabolism and growth. By inserting the gene into low and high copy number plasmids the amount of adenylate kinase in the cell can be varied. The best way to do this experiment, however, is to place the gene under control of a regulated promoter. The wild type gene has been inserted into a plasmid where its expression is controlled by the tac promotor. The construct needs to be characterized further, and then it will be used for experiments to determine the effect of adenylate kinase concentration on cell metabolism. Further experiments on adenine nucleotide levels, etc., have been awaiting construction of this strain. The fourth specific aim involves the structure and dynamic properties of adenylate kinase. The third specific aim has been delayed.

13618 **(DOE/FTR—9004959) [First international symposium on ruthenium and other non platinum metal complexes in cancer chemotherapy, Trieste, Italy, and Seventh international symposium on radiopharmaceutical chemistry, Groningen, The Netherlands, June 28--July 8, 1988]: Foreign trip report.** Srivastava, S.C. (Brookhaven National Lab., Upton, NY (USA)). 6 Sep 1988. Contract AC02-76CH00016. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004959/JAW.

The First International Symposium on Ruthenium and Other Non Platinum Metal Complexes in Cancer Chemotherapy was held in Trieste, Italy. The aim of this meeting was to update the knowledge in the field by bringing together international experts for discussions, and to evaluate the future perspectives of ruthenium and other non platinum transition metal complexes as potential anticancer drugs. A number of topics were covered, including the synthesis, structure, in-vivo evaluation, and the mechanisms of action of anticancer compounds based on ruthenium and other transition metal elements. The Seventh International Symposium on Radiopharmaceutical Chemistry was convened in Groningen, The Netherlands. These symposia take place every 2 years and involve the participation of international workers in the area of radionuclides and radiopharmaceuticals. The scope of this symposium included design, preparation, and quality control of radiopharmaceuticals; production of radionuclides including target design and automation of chemical processes; and related chemical and biochemical studies. The presented papers consisted of original research data on specific topics in the above areas.

13619 **(DOE/FTR—9005117) [Sigrid Juselius Foundation symposium on tracers in diagnostic imaging, Helsinki, Finland, May 21--27, 1988]: Foreign trip report.** Srivastava, S.C. (Brookhaven National Lab., Upton, NY (USA)). 28 Jul 1988. Contract AC02-76CH00016. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005117/JAW.

The 12th biannual symposium of the Sigrid Juselius Foundation was held in Finland on "Tracers in Diagnostic Imaging". The aim of this meeting was to continue on recent imaging modalities including PET, MRI, and SPECT. People actively working in these areas were invited to present lectures that covered a number of specific topics such as radiochemistry and radiopharmaceuticals, instrumentation developments, and preclinical and clinical applications. A total of 39 lectures were included with extensive discussion periods following each lecture. The presentation were organized into seven sessions dealing with such diverse areas as pharmacology, tumor receptors, organ-specific tracers, immunology, and clinical applications. These covered state-of-the-art review lectures as well as presentations of latest research data in the use of MRI, PET, and SPECT for diagnostic imaging.

13620 **(INIS-mf—11339) Topics in clinical oncology. 15.** Cepcek, P. (ed.). (Ustav Klinickej Onkologie, Bratislava (Czechoslovakia)). Dec 1987. 132p. (In Czech, Slovak). NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88705271/JAW.

The monograph comprising primarily papers on topical subjects of oncology and cancer research, contains also a selection of papers presented at the 2. Congress of the Czechoslovak Society of

Nuclear Medicine and Radiation Hygiene. Seven papers were selected on behalf of their subject related to clinical oncology. All of them were iputted in INIS; five of them deal with the scintiscanning of the skeleton of cancer patients, one with radioimmunodetection of tumors, and one with radionuclide lymphography. (A.K.).

13621 **(INIS-mf—11893) Diagnostic value of quantitative scintiscanning in tumours and tumour-like lesions of the skeleton.** Schmitt-Orlewicz, C. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 27 May 1986. 38p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756617/JAW.

Following administration of 99mTc phosphate compounds quantitative scintiscanning and, in particular, the 'region of interest' technique were used in 277 patients investigated for tumours and tumour-like lesions of the extremities. The following results were obtained: 1) In primary malignant bone tumours of the extremities tracer accumulation is increased by a factor of more than 2.5 as compared to that observed in normal bone tissue (the only exception here being plasmacytoma and histiocytoma). 2) In metastatic and benign bone tumours this tendency towards increased tracer accumulation generally is less pronounced so that the values calculated here remained below a factor of 2.5. 3) The accumulation behaviour of tumour-like bone changes of the extremities did not follow a uniform pattern. 4) As a general rule, the values measured in the region of the vertebral column were increased by a factor of less than 2.5. Quantitative scintiscanning, even though being a step towards a more sophisticated radiopharmaceutical method of examination, may occasionally not provide all the information required to establish a firm diagnosis or to evaluate the severity of a disease. One important domaine of this technique is the medical surveillance of patients, both before and after treatment. (TRV).

13622 **(LA—11473-MS) Use of superconducting imaging surfaces to enhance detection of weak magnetic sources by SQUID systems.** Overton, W.C. Jr.; van Hulsteyn, D.B.; Flynn, E.R. (Los Alamos National Lab., NM (USA)). Jan 1989. Contract W-7405-ENG-36. 94p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006568/JAW.

The use of superconducting magnetometers and gradiometers to detect weak magnetic signals is well known. The weak sources produce small field changes in the vicinity of superconducting pickup coil combinations which respond to changes in the local magnetic flux. When coupled to SQUID detectors, these systems can respond to changes as small as 10 ft. However, magnetic noise severely restricts the operation of such systems. We show that combinations of flat and curved superconducting sheets in combination with superconducting pickup coils can enhance the detection capability and improve noise rejection. Surface currents induced in the sheets are represented by the source dipole and its image. They give rise to signals similar to those of the first-order gradiometer. The theory of images is used to analyze the signals. Several configurations of sense coils and superconducting imaging surfaces are analyzed. 15 refs., 28 figs.

5507 Microbiology

REFER ALSO TO CITATION(S) 12512, 12518, 12571, 12577, 12707, 12752, 13276, 13606, 13611

13623 **(LA-UR—88-3540) PQQ: Biosynthetic studies in Methylobacterium AM1 and Hyphomicrobium X using specific ^{13}C labeling and NMR.** Houck, D.R.; Hanners, J.L.; Unkefer, C.J.; van Kleef, M.A.G.; Duine, J.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-8809195—1). NTIS, PC A02 - OSTI. Order Number DE89002354/JAW.

From 1. international symposium on PQQ and quinoproteins; Delft, Netherlands (5 Sep 1988).

Using ^{13}C labeling and NMR spectroscopy we have determined biosynthetic precursors of pyrroloquinoline quinone (PQQ) in two closely related serine-type methylotrophs, Methylobacterium AM1 and Hyphomicrobium X. Analysis of the ^{13}C-labeling data revealed that PQQ is constructed from two amino acids: the portion containing N-6, C-7,8,9 and the two carboxylic acid groups, C-7' and 9', is derived-intact-from glutamate. The remaining portion is derived from tyrosine; the phenol side chain provides the six carbons of the ring containing the orthoquinone, whereas internal cyclization of the amino acid backbone forms the pyrrole-2-carboxylic acid moiety. This is analogous to the cyclization of dopaquinone to form dopachrome. Dopaquinone is a product of the oxidation of tyrosine (via dopa) in reactions catalyzed by monophenol monooxygenase (EC 1.14.18.1). Starting with tyrosine and glutamate, we will discuss possible biosynthetic routes to PQQ. 29 refs., 4 figs., 2 tabs.

13624 **Two-gigaflop computer for macromolecular simulations.** Brooks, B.R. (to Dept. of Health and Human Services, Washington, DC). US Patent Application 7-261,304. 24 Oct 1988. 57p. NTIS, PC A04/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

An architecture for a special-purpose, high-speed digital computer particularly adapted for performing calculations for molecular manipulations and simulations at high speed and utilizing application specific integrated circuits (ASIC's). The architecture fully implements a periodic boundary potential based on the minimum image convention, has the capability to compute the pressure based on the virial equations, and allows for constant-temperature and -pressure simulations.

5509 Pathology

REFER ALSO TO CITATION(S) 13579, 13669, 13670, 13671

13625 **(PB—89-129415/XAB) Use of genetic-activity profiles in hazard evaluation.** Waters, M.D.; Stack, H.F.; Brady, A.L. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). Nov 1988. 23p. (EPA—600/D-88/246). NTIS, PC A03/MF A01.

A methodology was developed to display and evaluate multiple-test quantitative information on genetic toxicants for purposes of hazard/risk assessment. Dose information is collected from the open literature: either the lowest effective dose or the highest ineffective dose tested is recorded for each agent and bioassay system. For each agent in the data base, the quantitative results from genetic and related test systems are represented by computer-generated bar graphs genetic activity profiles. Bioassay systems are organized according to classes of genetic activity and subdivided by the phylogenetic level of the test organism. Genetic activity profiles were prepared 187 chemicals, e.g., dibromochloropropane, for the use of the International Agency for Research on Cancer (IARC) Working Group.

5520 Public Health

REFER ALSO TO CITATION(S) 12965, 13516, 13517, 13518, 13519, 13520, 13524, 13683

13626 **(PB—89-852222/XAB) Welding: personnel safety. January 1970-December 1988 (Citations from the NTIS data base). Report for January 1970-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 109p. NTIS PC N01/MF N01.

Supersedes PB—85-862159.

This bibliography contains citations concerning the health and occupational-safety hazards to which welding personnel are exposed. Federal regulations and standards, health hazard evaluation reports, systems and techniques for monitoring welding hazards, research on materials that require special handling, and OSHA recommendations and policies are among the topics discussed. (This updated bibliography contains 170 citations, 28 of which are new entries to the previous edition.)

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 12996

13627 **(CNIC—00134) Study into mutagenic effects of radiation on nutritional quality of summer soybean.** Zhan Mingkui; Zhao Jingrong. (Shandong Academy of Agricultural Sciences, Jinan (China). Crops Research Inst.). (China Nuclear Information Centre, Beijing, BJ). Jan 1988. 12p. (In Chinese). (A37-IAAE—0010). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705054/JAW.

The experiment showed that the highest protein and fat contents in M/sub 2/ and M/sub 3/ mutant groups were 2.6% and 2.15% for protein, and 0.59% and 0.49% for fat, respectiyely, up on that of controls. Mutagenic effect of protein is better than that of fat. Mutagenic effects could be observed in 17 kinds of amino acid and 5 kinds of lipid acids, especially in methionine and linolenic acid. The highest methionine content in mutagenic groups was increased by 91% compared with that of control and the content of linolenic decreased by 0.18 to 0.70% with a frequency of 30%. The correlations between 17 kinds of amino acid and protein contents and between 6 kinds of lipid acid and oil contents were evaluated respectively to supply the reference for improving the nutritional quality of summer soybean in breeding and field selection.

13628 **(CNIC—00145) Genetic variation of soybean agronomic characters induced by irradiation of seed.** He Zhihong; Wang Jinling. (Heilongjiang Academy of Agricultural Sciences, Hejiang, HL (China). Soybean Research Inst.). (China Nuclear Information Centre, Beijing, BJ). Feb 1988. 20p. (In Chinese). (A23-IAAE—0014). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705058/JAW.

Dry seeds of three soybean varieties were irradiated by /sup 60/Co γ ray with dosage of 4.1C/kg. The varieties irradiated were Fengshou No. 10, Donghong 74-403 and Heinong No. 26, and non-irradiated seeds of the corresponding variety was used as a control. The following genetic parameters of the nine agronomic characters were estimated, including genotypic coefficient of variation, genotypic variance, broad sense heritanility and genetic advance expected through selection. Three types of plant in M/sub 2/ and M/sub 3/ were used for the estimation of these parameters which comprise semisterility (MS), fertility (MF) in M/sub 1/ and control (CK). The genetic advance expected through selection was compared with the actual effect of selection for date of maturity, seed weigh per plant and 100 seed wight. The pattern of the genetic variation in the early generations of the induced population was analysed. Problems of selection for main agronomic characters in the early generations, and significance of fertility of M/sub 1/ plants for mutation breeding were discussed.

13629 **(EPS—3/HA/2) Long-term ecological behaviour of abandoned uranium mill tailings. Growth patterns of indigenous vegetation on terrestrial and semi-aquatic areas.** Kalin, Margarete. (Toronto Univ., Ontario (Canada). Inst. for Environmental Studies). (Environment Canada, Ottawa, Ontario. Environmental Protection Service). Dec 1984. 117p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705074/JAW.

Semi-aquatic and terrestrial areas on abandoned or inactive uranium mill tailings in Ontario were studied in order to identify the growth characteristics of the naturally invading species dominating these areas. Semi-aquatic areas of tailings sites have been invaded by cattails. These species formed wetland communities which varied in size, but all were essentially monocultures of Typha latifolia, T. angustifolia, or of the hybrids T. glauca. Sedges, Scripus cyperinus (wool-grass) and Phragmites australis (reed-grass), were found in transition zones between the cattail stand and the dry section of the tailings site. The expansion of the cattail stands appeared to be controlled by the hydrological conditions on the site, rather than the chemical characteristics of the tailings.

13630 **(PB—89-853493/XAB) Food-packaging materials: migration of constituents into food contents. January 1982-December 1988 (Citations from Packaging Science and technology Abstracts data base). Report for January 1982-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 43p. NTIS PC N01/MF N01.

This bibliography contains citations concerning the migration of food-packaging materials into foods. Plastic, glass, cardboard, metal, and ceramic containers are discussed. Techniques for analyzing packaging contamination are included. (Contains 90 citations fully indexed and including a title list.)

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 13644

13631 **(AD-A—199618/0/XAB) AFRRI (Armed Forces Radiobiology Research Institute) reports, April, May and June 1988. Second quarter 1988. Technical report.** (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). Aug 1988. 145p. NTIS, PC A07/MF A01.

Includes rept. nos. AFRRI-SR88-10 through AFRRI-SR88-19.

This volume contains AFRRI Scientific Reports SR88-10 through SR88-19 for Apr-Jun 1988. Contents: Radiation: Behavioral implications in space; Electron spin response (ESR) and spin trapping of free radicals produced in poly U and poly A using the boron neutron-capture reaction; Age-related decrements in the muscarinic enhancement of K+-evoked release of endogenous striatal dopamine: an indicator of altered cholinergic-dopaminergic reciprocal inhibitory control in senescence; Alterations in muscarinic control of striatal dopamine autoreceptors in senescence: a deficit at the ligand-muscarinic receptor interface; Flow cytometric characterization of rat thymus cells in a radiation dominated model of combined injury; Opposite effects of WR-2721 and WR-1065 on radiation-induced hypothermia: Possible correlation with oxygen uptake; Long-term effects of radioprotector WR-2721 on locomotor activity and body weight of mice following exposure to ionizing radiation; Effects of a phorbol ester on rat aortic contraction and calcium influx in the presence and absence of BAY k 8644; Quantitative, functional and biochemical alterations in the peritoneal cells of mice exposed to whole-body gamma irradiation: Changes in cellular protein, adherence properties and enzymatic activities associated with platelet-activating factor formation and inactivation, and arachidonate metabolism; Magnetic resonance imaging and contrast enhancement.

13632 **(AD-A—199956/4/XAB) Mechanisms of radiation-induced emesis. Technical report, 10 February 1984-1 March 1987.** Carpenter, D.O. (Albany Medical Coll., NY (USA)). 31 Aug 1988. 57p. NTIS, PC A04/MF A01.

Nausea and vomiting following radiation exposure are factors which may seriously limit the ability of humans to perform in military situations and are side effects of such significance in radiation therapy that they may limit the patient's acceptance of treatment regimes (1). At doses of 1.5 Gy approximately 50% of humans experience nausea and vomiting, while at 3.0 Gy the figure approaches 100%. While irradiation almost anywhere may produce symptoms, the upper abdomen is the most-sensitive site. Dogs, cats, and monkeys also vomit on exposure to ionizing radiation, although cats and monkeys are considerably more resistant than dogs and man. These studies were designed to attempt to determine the roles of the area postrema and the vagus in radiation-induced emesis by ablation and electrophysiological studies, and to test the effects of some drugs on the emetic response. In addition, the authorrecorded from neurons in the dog area postrema, applying substances which may be emetic, in an attempt to determine which transmitters, peptides and hormones might function as chemical mediators of emesis. Finally, he have tested the emetic effects of some of these substances given intravenously in awake dogs, with particular emphasis

on study of the mechanism of action of emetic agents on the area postrema neurons.

13633 **(AD-A—200240/0/XAB) Radiation: behavioral implications in space.** Bogo, V. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1988. 10p. (AFRRI-SR—88-10). NTIS, PC A02/MF A01.

Pub. in Toxicology, Vol. 49, 299-307(1988).

Since future space missions are likely to be beyond Earth's protective atmosphere, a potentially significant hazard is radiation. The following behavioral situations are addressed in this paper: (1) space radiations are more effective at disrupting behavior; (2) task demands can aggravate the radiation disruption; (3) efforts to mitigate disruption with drugs or shielding are not satisfactory and the drugs can be behaviorally toxic; and (4) space and radiation-induced emesis combined may be synergistic. Thus, future space travel will be a demanding, exciting time for behavioral toxicologists, and while the circumstances may seem insurmountable at first, creative application of scientific expertise should illicit solutions, similar to demanding situations confronted before.

13634 **(CEA-R—5441) Dosimetry and therapy of skin contaminations.** Piechowski, J.; Menoux, B.; Chaptinel, Y.; Durand, F. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire; CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service Medical du Travail). (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire). Oct 1988. 108p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756659/JAW.

This study has been developed to provide guidance to physicians on the handling of skin contaminations in some accidental circumstances. The first stage of diagnosis and consequently of the possible therapy in order to avoid or mitigate radiodermatitis is to appreciate the importance of the contaminations and to foresee their local consequences. Two theoretical cases have been considered: a) strictly superficial contamination; b) deep contamination with homogeneous penetration of the contaminant into the epidermis. The superficial and deep theoretical distributions correspond respectively to the lower and upper absorbed doses in the basal layer. Tables of dose equivalent rates and committed dose equivalents to the skin are supplied for a large number of radionuclides likely to be met in the nuclear industry as well as in various fields of research, medicine and pharmacology using radioactive techniques. Besides these theoretical dose factors, the practitioner will find monitoring procedures, dose calculations and practical data concerning decontamination.

13635 **(CNIC—00068) Study on lead transportation in air-water-paddy system with /sup 210/Pb as tracer.** Li Shuding; Zhang Hairong; Ma Xuejun. (Academia Sinica, Shenyang, LN (China). Inst. of Forestry and Pedology). (China Nuclear Information Centre, Beijing, BJ). Aug 1987. 14p. (In Chinese). (AS-IFP—0005). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705031/JAW.

With /sup 210/PbCl/sub 2/ as tracer, a research into lead sources in brown rice, lead distribution in soil and rice, lead chemical forms in soil and their change with time, availability of soil for rice and effect of soil pH on the Pb adsorption was carried out in air-water-paddy system near cities and towns located upper and middle reaches of Liaohe River, northeastern China. Test soil was light acid meadow brown soil. The Pb proportions in rice grain derived from the soil, airborne dust and irrigation water and the transportation pathway to brown rice were investigated. Transportation coefficients of Pb in the system were determined by tracer experiment. It was indicated that the Pb concentration in rice root, the Pb concentration and its distribution in the soil are main factors effecting Pb transportation to rice. Based on the simulation test, mathematical model for computing soil environmental capacity of Pb in the system is put forward. The soil environmental capacity of Pb computed is 1600 - 1700 ppm, i.e. 3.6 - 3.8 t/ha. The computed result was in agreement with the observed. The mathematical model was also used to compute soil enviromental capacity of those heavy metal corresponding respectively with /sup 203/Hg, /sup 115+115m/Cd, /sup 65/Zn, /sup 51/Cr, /sup 65/Ni, /sup 60/Co etc.

13636 **(CNIC—00086) Study on the radiotoxicology of enriched uranium.** Zhu Shoupeng; Zheng Siying; Wang Guolin; Wang Chongdao; Cao Genfa. (Suzhou Medical Coll., JS (China)). (China Nuclear Information Centre, Beijing, BJ). Dec 1987. 8p. (In Chinese). (SMC—0011). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705041/JAW.

A study on the retentive peculiarity of soluble enriched uranium UO/sub 2/F/sub 2/ were observed after iv once or consecutive ip qd x 3d to Wistar male rats. The dynamic retention of radioactivity in the body showed that the enriched uranium UO/sub 2/F/sub 2/ was chiefly localized in kidney, and then in skeleton and liver. The radioactivity of the enriched uranium UO/sub 2/F/sub 2/ in skeleton rose steadily while the concentration in kidney and liver droped. When enriched uranium UO/sub 2/F/sub 2/ was accumulated in organism, it caused chromosome aberrations on bone marrow cells. Results indicated that the chromosome aberration rates were elevated when the dose of the enriched uranium UO/sub 2/F/sub 2/ was increased, at the same time, the cell division was depressed. Accumulation of insoluble enriched uranium U/sub 3/O/sub 8/ in gastrointestinal tract was well described by a two exponential expression. Values of retention estimate for fast component, T/sub 1/ = 0.34 d, and for relatively long term component, T/sub 2/ = 4.05 d. The deposition of UO/sub 2/F/sub 2/ in the intact skin was only 0.16 to 0.18% of the total contaminated UO/sub 2/F/sub 2/. Penetration of the enriched uranium UO/sub 2/F/sub 2/ was dominantly increased in abraded skin. This value is about 25 to 32 times as compaired with that in intact skin. Retention of the enriched uranium UO/sub 2/F/sub 2/ through abraded skins was dominantly localized in kidney and skeleton.

13637 **(DOE/ER/60614—1) Localization of low density lipoproteins in vivo: Final technical report, September 28, 1987--September 27, 1988.** Harper, P.V. (Chicago Univ., IL (USA)). Dec 1988. Contract FG02-87ER60614. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005749/JAW.

We have found that low density lipoprotein derivatized with I-123- tyramine cellobiose (I-123-TyC-LDL) behaves like native LDL when used for biodistribution studies in animals and in humans, and that I-123-TyC-LDL appears more promising than Tc-99m-labeled LDL for nuclear imaging of the coronary circulation. Unfortunately, isolation of LDL for direct derivatization with I-123-TyC is both time-consuming and affords a low but real probability of contamination. Methods for radiolabelling LDL indirectly or without prior purification would circumvent this problem. Moreover, modifications that could increase the specific activity of I-123-labelled LDL are desirable. For this project we proposed to establish a novel, rapid method for indirect radioiodination of LDL particles to be used in experimental and clinical nuclear imaging studies. We have found that small, model beta-strand peptides (MBPs) very selectively bind to LDL and that MBPs can be labelled with I-123-TyC. We have analyzed the in vivo behavior of two different types of semisynthetic I-123-TyC-LDL particles{endash}generated by adsorption of radiolabelled MBPs to native LDL{endash}in rabbits. With either preparation, clearance of radiolabelled MBPs from the circulation was more rapid than that of native LDL. 6 refs., 6 figs.

13638 **(DOE/FTR—9004957) [International Commission on Radiological Protection, Bariloche, Argentina, September 23--October 1, 1988]: Foreign trip report.** Meinhold, C.B. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004957/JAW.

The major efforts were concerned with review of the new ICRP report on optimization, a review of the work of the Commission's four committees, and the extended discussion on the work of the task group revising ICRP Publication 26 which deals with the Commission's basic recommendations. A statement from the Commission on the progress of this task group effort is attached.

13639 **(DOE/FTR—9005072) Third international symposium on neutron capture therapy, Bremen, FRG, KFA, Juelich, FRG, 20 May--12 June 1988: Foreign trip report.** Bond, V.P. (Brookhaven National Lab., Upton, NY (USA)). 14 Jul 1988. Contract AC02-76CH00016. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005072/JAW.

The Third International Symposium on NCT was a well-organized and successful meeting, with 95 papers presented by individuals from 19 different countries. Highlights were reports on three patients with malignant melanoma treated with NCT in Japan, continuation of this treatment for glioblastoma with about 100 patients total now treated, and description of newly proposed patient treatment (H-10) facility, using AL/S/Ar after 25 MW DIDO/PLUTO reactors at the Harwell Laboratory for initiation of phase I clinical trials at Radcliffe Infirmary, Oxford; based largely on Brookhaven data on porphyrins, BSH, BSSB, and beam development.

13640 **(DOE/NV/10574—2) Pharmacokinetic models relevant to toxicity and metabolism for uranium in humans and animals.** Wrenn, M.E.; Lipsztein, J.; Bertelli, L. (Utah Univ., Salt Lake City (USA). School of Medicine). 1988. Contract AC08-86NV10574. 14p. (CONF-880514—7). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005576/JAW.

From Workshop on biological assessment of occupational exposure to actinides; Versailles, France (30 May 1988).

The aim of this paper is to summarize pharmacokinetic models of uranium metabolism. Fortunately, others have recently reviewed metabolic models of all types, not just pharmacokinetic models. Their papers should be consulted for greater biological detail than is possible here. Improvements in the models since these other papers are noted. Models for assessing the biological consequences of exposure should account for the kinetics of intake by ingestion, inhalation, and injection, and the chemical form of uranium; predict the time dependent concentration in red blood cells, plasma, urine, kidney, bone and other organs (or compartments); and be adaptable to calculating these concentrations for varying regimens of intake. The biological parameters in the models come from metabolic data in humans and animals. Some of these parameters are reasonably well defined. For example, the cumulative urinary excretion at 24 hours post injection of soluble uranium in man is about 70%, the absorbed fraction for soluble uranium ingested by man in drinking water during normal dietary conditions is about 1%, and the half time in the mammalian kidney is several days. 17 refs., 8 figs.

13641 **(DOE/RL/01830—T59) Radioactivity and health: A history.** Stannard, J.N.; Baalman, R.W. Jr. (ed.). (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 1976p. NTIS, PC A99/MF A01 - OSTI; 1; GPO Dep. Order Number DE88013791/JAW.

This book is designed to be primarily a history of research facts, measurements, and ideas and the people who developed them. "Research" is defined very broadly to include from bench-top laboratory experiments to worldwide environmental investigations. The book is not a monograph or a critical review. The findings and conclusions are presented largely as the investigators saw and reported them. Frequently, the discussion utilizes the terminology and units of the time, unless they are truly antiquated or potentially unclear. It is only when the work being reported is markedly iconoclastic or obviously wrong that I chose to make special note of it or to correct it. Nevertheless, except for direct quotations, the language is mine, and I take full responsibility for it. The working materials for this volume included published papers in scientific journals, books, published conferences and symposia, personal interviews with over 100 individuals, some of them more than once (see Appendix A), and particularly for the 1940--1950 decade and for the large government-supported laboratories to the present day, "in-house" reports. These reports frequently represent the only comprehensive archive of what was done and why. Unfortunately, this source is drying up because of storage problems and must be retrieved by ever more complex and inconvenient means. For this reason, special efforts have been taken to review and document these sources, though even now some sections of the field are partially inaccessible. Nevertheless, the volume of all materials available for this review was surprisingly large and the quality much better than might have been expected for so complex and disparate a fields approached under conditions of considerable urgency.

13642 **(EGG-M—88103) A proposed protocol for clinical trials of boron neutron capture therapy in glioblastoma multiforme.** Dorn, R.V. III; Spickard, J.H.; Griebenow, M.L. (EG and G Idaho, Inc., Idaho Falls (USA); Mountain States Tumor Inst., Boise, ID (USA)). 1988. Contract AC07-76ID01570. 10p. (CONF-8802102—4). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005274/JAW.

From BNL BNCT workshop; Upton, NY, USA (1 Feb 1988).

Neutron Capture Therapy (NCT) was suggested in theory as a treatment for malignant tumors some 50 years ago. Since then, considerable data have accumulated on the mechanisms of action and possible application of this technique. This paper outlines a protocol for a controlled study of the use of Boron Neutron Capture Therapy (BNCT) for the treatment of Glioblastoma Multiforme (GM). The protocol is one component of a comprehensive national BNCT research program at the Idaho National Engineering Laboratory (INEL) directed towards validating (or invalidating) NCT as a treatment for human malignancies.

13643 **(EGG-M—88282) Boron neutron capture therapy: Brain Tumor Treatment Evaluation Program.** Griebenow, M.L.; Dorn, R.V. III; Gavin, P.R.; Spickard, J.H. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 9p. (CONF-880911—27). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005424/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

The United States (US) Department of Energy (DOE) recently initiated a focused, multidisciplined program to evaluate Boron Neutron Capture Therapy (BNCT) for the treatment of brain tumors. The program, centered at the DOE{endash}Idaho National Engineering Laboratory (INEL), will develop the analytical, diagnostic and treatment tools, and the database required for BNCT technical assessment. The integrated technology will be evaluated in a spontaneously-occurring canine brain-tumor model. Successful animal studies are expected to lead to human clinical trials within four to five years. 2 refs., 3 figs.

13644 **(GSI—88-58-Prepr.) Radiobiological experiments with heavy ions. A comparison of the cross section of different biological endpoints.** Kraft, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Nov 1988. 25p. (CONF-8810282—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756497/JAW.

From Workshop on mutagenic effects of heavy ions; Dubna, USSR (1 Oct 1988).

In experiments, performed at the Unilac, Bevalac, and Ganil a large body of radiobiological data, cross sections for cell inactivation and mutation, induction of both, chromosome aberrations, and strand breaks of DNA have been measured for different atomic numbers, from helium ($Z=2$) to uranium ($Z=92$), and at an LET range from 10 to 16000 keV/μm. These data exhibit a common feature: At LET values below 100 keV/μm all data points of one specific effect form one single curve as a function of LET, independent from the atomic number of the ion. In this LET range, the biological effects are independ from the particle energy or track structure and depend only on the energy transfer. Therefore, LET is a good parameter in this regime. For LET values greater than 100 keV/μm, the curves for the different ions separate from the common curve in order of increasing atomic numbers. In this regime LET is no longer a good parameter and the physical parameters of the formation of particle tracks are important. The similarity of the σ-LET curves for different endpoints shows that the 'hook-structure' is produced by physical and chemical effects which occur before the biologically relevant lesions are formed. For this part of the reaction chain only a very limited amount of data are available.

13645 (IC—88/323) Propagation of the nerve impulse under the effect of a magnetic field. Chela-Flores, J.; El-Sayed, E.M.; Wang, X.Y. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 18p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705371/JAW.

The recent significant advance in superconductivity at high temperatures has raised an important problem in biophysics, in view of the underlying interest that has arisen in experiments in which very high magnetic fields are needed (in the multi-tesla range). This is occurring against a theoretical background in which there is no reliable way of estimating the effect of magnetic fields on the central nervous system. This has led us to discuss the problem of the coupling of magnetic fields with the coherent propagation of the polarization of the plasma membrane along the axon. Our work lies within the context of the phenomenological model of nerve impulse propagation due to Hodgkin and Huxley. Using the concept of gauge invariance we find that the magnetic field has a non negligible effect on the velocity of propagation of the action potential in the limit of the Fitzhugh-Nagumo equation without recovery, but more realistic cases do not change the main conclusions of this work. (author). 26 refs.

13646 (INFO—0230) Review of effect of soil on radionuclide uptake by plants. Sheppard, S.C.; Evenden, W.G. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Mar 1987. 116p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705133/JAW.

This review was undertaken to improve the understanding of, and to compile the available data concerning, the transfer of uranium (U), thorium (Th) and lead (Pb) from soils to plants. The emphasis of the review was on the absorption of these elements from the soil by plant roots, and the mechanisms underlying this process were outlined. The behaviour of U, Th and Pb in soils and plants was discussed with illustration by data from the literature. An extensive compilation of plant/soil concentration ratios (CR) was completed and the most relevant data for Canadian nuclear facilities were selected. Very few data were found for edible plants and these did not represent the range of soil types found near Canadian nuclear facilities. Recommendations of the most fruitful research directions were made. 69 refs.

13647 (INFO—0245) Effect of changes in humidity on the size of submicron aerosols. Phillips, C.R.; Khan, A. (Toronto Univ., Ontario (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jun 1987. 147p. NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88705142/JAW.

The effect of humidity on inhaled aerosols in the respiratory tract is to cause an increase in particle size of up to several times if the aerosol particle is hygroscopic. The presence of ionizing radiation and air ions (for example, from uranium and radon/thoron) increases the tendency of water vapour to nucleate. The desposition of particles in the lung is enhanced by high charge density (>10 charges/particle). Radon has been reported to play an important role in the formation of sulphate and nitrate particles in the atmosphere. A detailed overview of the effect of humidity on aerosols is presented in the present work. Results of experimental measurements made on NaCl (hygroscopic) and kerosene combustion (hydrophobic) aerosols under ambient and humid conditions are reported. Initial aerosol conditions were 20 degrees C and 35% R.H. Final aerosol conditions were maintained at 37 degrees C and 100% R.H. in order to simulate the conditions inside the respiratory tract. An average growth factor of 1.9 +- 0.4 (standard deviation) was observed for the NaCl aerosol and 1.3 +- 0.2 (standard deviation) for the kerosene aerosol. For the activity size distribution, however, the NaCl aerosols were observed to grow by an average factor of only 1.2 +- 0.1 (standard deviation) whereas the kerosene aerosols grew by a factor of 1.3 +- 0.2 (standard deviation).

13648 (NRCN—590) Changes in the endocrine system which controls reproduction in female rats neonatally exposed to a low-dose of gamma irradiation. Freud, A. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev; Ben-Gurion Univ. of the Negev, Beersheba (Israel)). Jun 1988. 81p. (In Hebrew). NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705388/JAW.

Exposure of animals to high doses of ionizing radiation causes irreversible damage to the reproductive system and brings upon infertility. The results of this work indicate that neonatal exposure of female rats on day 8 of life to gamma irradiation of 6 R and 15 R causes reduction in number of offspring these rats produce when mature. The latter results from hormonal changes in the endocrine system which controls reproduction. However, one could not define one site of the hypothalamo - hypophyseal - ovarian axis which when damaged would be responsible for the radiation-induced damage to the productive system.

13649 (NRPB-R—212) Probability of plutonium intakes and doses exceeding estimates from personal air sampling. Birchall, A.; James, A.C.; Muirhead, C.R. (National Radiological Protection Board, Chilton (UK)). Jun 1988. 42p. H.M. Stationery Office, London, price Pound 5.00.

A method assuming Poisson distribution of particles in space and a log-normal distribution of aerosol size to evaluate the probability distribution of intake from a single measurement of activity on a personal air sampler (PAS) filter has been extended to apply over the practical range of activities collected in PAS monitoring, and simple algebraic expression derived to approximate the probability of a man's intake exceeding the estimated value by given factors. This is used to study the effect of aerosol size distribution. A new composite parameter to characterise aerosol size distributions is suggested. The expression is also used to assess effect of particle density and specific activity on sampling statistics, to enable the analysis to be applied to an aerosol where each particle is a mixture of a /sup 239/Pu compound (or other radionuclide) and a non-radioactive material. Similar expressions for the probability of exceeding estimated committed dose equivalents and committed effective dose equivalents are derived, taking into account the effects of solubility classification. Short computer programs are provided to evaluate these probabilities. The results' radiological implications are discussed.

13650 (PNL-SA—16470) Use of archived tissues for studies of plutonium-induced lung tumors. Sanders, C.L.; McDonald, K.E.; Lauhala, K.E.; Frazier, M.E. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 11p. (CONF-8810209—9). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005617/JAW.

From 27. Hanford life sciences symposium on health and the environment; Richland, WA, USA (18 Oct 1988).

Previous lifespan studies in rats exposed to plutonium-239 aerosols indicated that lung tumor incidence might be increased at radiation doses to the lung comparable to doses received by humans from a maximum permissible occupational lung deposition of 0.6 kBq ^{239}Pu. A total of 3,192 young adults, female, SPF, Wistar rats were used in the initial lifespan study: 2,134 were exposed to $^{239}PuO_2$ at initial lung burdens (ILB) ranging from 0.009 to 6.7 kBq, and 1,058 were sham-exposed controls. Histopathological analyses have been completed on 1707 of the 3,192 rats, including 54 sham-exposed control sand 1153 exposed animals. Cell kinetics, autoradiographic and morphometric techniques are being used to evaluate the spatial-temporal dose-distribution patterns and the cellular events leadings up to lung tumor formation in 140 serially sacrificed female, Wistar rats given a single exposure to $^{239}PuO_2$ (ILB, 3.9 kBq). Protooncogene activation, growth factors and growth factor receptors, DNA cell content (by cell flow cytometry and microspectrophotometry) and cell proliferation (by ^{3}H-TdR nuclear labeling) are being examined in archival paraffin-block sections. 27 refs., 2 figs.

13651 **(SSI—88-15) Radiation hazards and chemical risks - a comparison.** Bengtsson, G. (National Inst. of Radiation Protection, Stockholm (Sweden)). 17 Aug 1988. 15p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756209/JAW.

Many cell mechanisms resulting in damage of living materials are of a similar kind for radiation and chemicals. Therefore it is not surprising that radiation and many chemicals can have a similar effect and result in i.a. cancer, fetus lesions and hereditarity changes. In the environment both radiation and number of chemicals occur. Strengthening as well as weakening effects are known, both from radiation in combination with chemicals and from various chemicals in combination. The report discusses the importance of this for risk assessment and for the possibility of comparing impacts of radiation and chemicals The human body possesses a great ability to protect itself from health hazards from radiation and chemicals. This even holds for cancer. Many large exposures are difficult to decrease, i.e. from smoking, sun-bathing and high content of fat in food. Thus, concentration of effects on strengthening of the body's defense ability should be an important complement to decrease of exposures. (O.S.).

13652 **(UCRL—15988) The effects of chronic radiation on reproductive success of the polychaete worm Neanthes arenaceodentata.** Harrison, F.L.; Anderson, S.L. (Lawrence Livermore National Lab., CA (USA)). Dec 1988. Contract W-7405-ENG-48. 57p. (EPA/520/1—88-004). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006053/JAW.

The effects of lifetime exposure to chronic irradiation on reproductive success were assessed for laboratory populations of the polychaete worm Neanthes arenaceodentata. Lifetime exposure was initiated upon the spawning of the P_1 female and was terminated upon spawning of the F_1 female. Groups of experimental worms received either no radiation (controls) or 0.19, 2.1, or 17 mGy/h. The total dose received by the worms was either background or approximately 0.55, 6.5, or 54 Gy, respectively. The broods from the F_1 mated pairs were sacrificed before hatching occurred, and information was obtained on brood size, on the number of normal and abnormal embryos, and on the number of embryos that were living, dying, and dead. The mean number of embryos in the broods from the F_1 females exposed to lifetime radiation of 0.19 and 2.1 mGy/h was not significantly different from the mean number of embryos from control females; however, the mean number of embryos was different from those F_1 females exposed to 17 mGy/h. There was a significant reduction in the number of live embryos in the broods from the F_1 mated pairs that were exposed to the lowest dose rate given, 0.19 mGy/h, as well as those exposed to 2.1 and 17 mGy/h. Also, increased percentages of abnormal embryos were determined in the broods of all the radiation-exposed groups. 39 refs., 10 figs., 15 tabs.

13653 **Determination of U in human tissues by delayed neutron activation analysis.** Gonzales, E.R.; Gladney, E.S.; Boyd, H.A.; McInroy, J.F.; Muller, M.; Palmer, P.D. (Los Alamos National Lab., NM (USA)). *Health Physics;* **55**: No. 6, 927-932(Dec 1988).

A rapid, sensitive and highly selective technique using Delayed Neutron Activation Analysis (DNAA) has been used to determine U concentrations in human tissues. Two different sample preparation techniques were compared: one involves total matrix destruction to a dry ash while the other is a nondestructive preparation of the wet sample. The data obtained from the analyses of the same sample by DNAA of wet tissues, DNAA of ashed tissues and from radiochemical analyses using alpha spectroscopy (a standard method of U determination) were statistically equivalent on the basis of variance analysis at the $p = 0.05$ level.

13654 **Eighth complementation group of rodent cells hypersensitive to ultraviolet radiation.** Thompson, L.H.; Shiomi, T.; Salazar, E.P.; Stewart, S.A. (Lawrence Livermore National Lab., CA (USA)). *Somatic Cell and Molecular Genetics;* **14**: No. 6, 605-612(Nov 1988).

Two mutant lines (US31, US46) of mouse lymphoma cells that are hypersensitive to ultraviolet (UV) radiation were previously found to belong to different complementation groups. The mutants were tested for their ability to complement the six known complementation groups of UV-sensitive Chinese hamster ovary (CHO) cells, which are defective in nucleotide excision repair, as well as a seventh group represented by a V79 mutant. Hybrid cells were produced by fusion with polyethylene glycol and tested in situ for UV resistance. The mouse mutant US46 complemented all CHO mutants except UV61. Therefore, US46 is assigned to the same complementation group as UV61, and it is probably defective in the same locus. The mouse mutant US31 produced UV-resistant hybrid cells in each of the seven crosses, indicating that it forms an eighth complementation group among the rodent mutants. Thus, at least eight genes are likely required to repair UV damage in rodent cells.

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REFER ALSO TO CITATION(S) 13545, 13596, 13651

13655 **(AD-A—200271/5/XAB) Evaluation of the aquatic toxicity and fate of brass dust using the standard aquatic microcosm. Technical report, September 1985-October 1986.** Landis, W.G.; Chester, N.A.; Haley, M.V.; Johnson, D.W.; Muse, W.T. (Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD (USA)). Jul 1988. 24p. (CRDEC-TR—88116). NTIS, PC A03/MF A01.

The impact of brass dust on a model aquatic ecosystem, the Standard Aquatic Microcosm (SAM), was investigated. Brass dust had dramatic effects on the interaction of trophic levels, community structure, and metabolism of nutrients. Copper was rapidly released from the dust material suspended in the water column. Brass dust has the potential to severely impact aquatic ecosystems.

13656 **(BNL—52123) Hazardous characterization and management of tetramethyl tin in the production of photovoltaic cell transparent conductive oxide layers.** Kalb, P.D.; Moskowitz, P.D. (Brookhaven National Lab., Upton, NY (USA)). Aug 1987. Contract AC02-76CH00016. 32p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005936/JAW.

Tetramethyl tin (TMT) has been used by the photovoltaics industry to prepare transparent conductive oxide films on glass. Significant health hazards, however may be associated with the use of TMT. Short-term exposures to TMT vapors in excess of accepted exposure limits can produce a range of physiological symptoms. Although less is known about the hazards from prolonged exposure to low levels of TMT, some studies suggest that effects are both cumulative and persistent. TMT also is highly flammable and emits toxic fumes on decomposition. In an occupational setting, workers may be routinely or accidentally exposed to TMT liquids or vapors. Approaches for controlling these occupational hazards are described. Analysis suggests that routine emissions from large scale manufacturing facilities using TMT will need to be reduced by approximately 90% to comply with toxic gas containment guidelines to protect public health. Thermal afterburners combined with particle filtration may be used to meet these guidelines. Accidental release of the total inventory of TMT at a large-scale plant may present hazards to individuals living about 1 km from the facility's boundary. Because of these hazards, strategies to prevent in-plant release coupled with community emergency response programs are needed. 36 refs., 3 figs., 6 tabs.

13657 **(GSF—5/88) Literature documentation on forest decline. December 1987. 1. sequel.** Schulte-Hostede, S.; Kirchner, M.; Waymreen, C.; Maier, B.; Reuther, M.; Mueller, T. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU)). Dec 1987. 267p. (In German). NTIS (US Sales Only), PC A12. Order Number DE88756520/JAW.

A literature documentation on forest decline has been worked out. It enables document retrieval by author, title, year, place of publication and keywords. (KG) With 997 refs.

13658 **(INIS-BR—1371) Determination of concentration factors for chromium, cesium, iron and cobalt in corvine and shrimp in the vicinities of Almirante Alvaro Alberto Nuclear Power Plant.** Kamel, L.N. (Universidade do Estado do Rio de Janeiro (Brazil). Centro Biomedico). 1988. 151p. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS. Order Number DE88705167/JAW.

In order to verify if the concentration factors for dose calculations in critical population recommended by the International Atomic Energy (IAEA), on the Safety Series 57, are in agreement with local factors, studies were carried out at Piraquara de Dentro bay, a region in the vicinities of the Almirante Alvaro Alberto Nuclear Power Plant (CNAAA). Chromium, caesium, iron and cobalt concentration factors for corvine and shrimp were determined using the activation analysis method by neutrons, taking into account the same behaviour between radioactive and stable from the same physicochemical form. This study has shown that: The local values of cesium, iron and cobalt concentration factors for corvine (fish) are in the same order of magnitude of the IAEA recommended values; The chromium, caesium and cobalt concentration factor values determined for shrimp for Piraquara de Dentro bay are in the same order of magnitude or smaller than those proposed by IAEA, while the concentration factor value for ion is one order of magnitude higher than the IAEA recommended value.

13659 **(PB—89-121487/XAB) RTECS (Registry of Toxic Effects Chemical Substances) regulatory subfile. Regulations, recommendations, and assessments (for microcomputers). Data file.** Fang, J.; Sweet, D. (Robert A. Taft Labs., Cincinnati, OH (USA)). 1985. vp. NTISCP D08.

See also PB—88-934400 and PB—88-934401. The data file is contained on 5 1/4-inch, double sided, double density diskettes, compatible with the IBM PC/XT or AT microcomputer. The diskettes are in the dBASE III Plus format. Price includes documentation, PB—87-222246.

Regulations, Recommendations, and Assessments Extracted from RTECS -- contains 4277 chemical substances that must have had one or more of the following data lines: OSHA standards, MSHA standards, DOT shipping regulations, NIOSH recommendations, ACGIH TLV, IARC assessments indicating positive or suspected carcinogenic activity in animals and/or man, and NTP positive carcinogenesis test results. Substances are listed in alphabetical order by the prime entry name. The data file can be searched by RTECS accession number, CAS Registry Number, or fragment of name or synonym. The diskettes were created using dBase III Plus under the DOS 3.1 operating system. They are in the Backup format.

13660 **(PB—89-123376/XAB) Health and environmental effects profile for isobutanol.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). May 1986. 70p. (EPA—600/X-86/149). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for isobutanol was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. Isobutanol has been determined to be a systemic toxicant. An Acceptable Daily Intake (ADI), defined as the amount of a chemical to which humans can be exposed on a daily basis over an extended period of time (usually a lifetime) without suffering a deleterious effect, for isobutanol is 0.3 mg/kg/day for oral exposure. The Reportable Quantity (RQ) value for isobutanol is 1000.

13661 **(PB—89-123384/XAB) Health and environmental effects profile for pyridine.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jun 1986. 90p. (EPA—600/X-86/168). NTIS, PC A05/MF A01.

The Health and Environmental Effects Profile for pyridine was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. Pyridine has been determined to be a systemic toxicant. An Acceptable Daily Intake (ADI), defined as the amount of a chemical to which humans can be exposed on a daily basis over an extended period of time (usually a lifetime) without suffering a deleterious effect, for pyridine is 0.002 mg/kg/day for inhalation exposure. The Reportable Quantity (RQ) value for pyridine is 100.

13662 **(PB—89-123418/XAB) Health and environmental effects profile for pentachloronitrobenzene.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Sep 1986. 121p. (EPA—600/X-86/267). NTIS, PC A06/MF A01.

The Health and Environmental Effects Profile for Pentachloronitrobenzene was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. Pentachloronitrobenzene has been evaluated as a carcinogen. The human carcinogen potency factor (q1*) for pentachloronitrobenzene is 0.262 (mg/kg/day) for oral exposure. The Reportable Quantity (RQ) value for pentachloronitrobenzene is 1000.

13663 **(PB—89-123426/XAB) Health and environmental effects profile for Direct Blue 6.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jan 1987. 71p. (EPA—600/X-87/063). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for Direct Blue 6 was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. Direct Blue 6 has been evaluated as a carcinogen. The human carcinogen potency factor (q1*) for Direct Blue 6 is 8.1 (mg/kg/day) for oral exposure. The Reportable Quantity (RQ) value for Direct Blue 6 is 100.

13664 **(PB—89-123459/XAB) Health and environmental effects profile for nitrotoluenes (o-, m-, p-).** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). May 1986. 92p. (EPA—600/X-86/143). NTIS, PC A05/MF A01.

The Health and Environmental Effects Profile for nitrotoluenes (o-, m-, p-) was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. Nitrotoluenes have been determined to be systemic toxicants. An Acceptable Daily Intake (ADI), defined as the amount of a chemical to which humans can be exposed on a daily basis over an extended period of time (usually a lifetime) without suffering a deleterious effect, for nitrotoluenes is 0.0143 mg/kg/day for oral exposure. The Reportable Quantity (RQ) value for nitrotoluenes is 1000.

13665 **(PB—89-124473/XAB) Health and environmental effects profile for pentachlorophenol.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jun 1986. 165p. (EPA—600/X-86/170). NTIS, PC A08/MF A01.

See also PB—86-134541.

This report was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. Quantitative estimates are presented provided sufficient data are available. Pentachlorophenol has been determined to be a systemic toxicant. An Acceptable Daily Intake (ADI), defined as the amount of a chemical to which humans can be exposed on a daily basis over an extended period of time (usually a lifetime) without suffering a deleterious effect, for pentachlorophenol is 0.03 mg/kg/day for oral exposure. The Reportable Quantity (RQ) value of 1, 10, 100, 1000 or 5000 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a release as specified by CERCLA based on chronic toxicity. The RQ value for pentachlorophenol is 100.

13666 **(PB—89-124739/XAB) Chromosomal changes associated with tumorigenic mineral fibers.** Palekar, L.D.; Eyre, J.F.; Coffin, D.L. (Northrop Services, Inc., Research Triangle Park, NC (USA)). Oct 1988. 33p. NTIS, PC A03/MF A01.

The purpose of this study is to investigate the cytogenetic characteristics of mineral fiber-induced rat pleural mesotheliomas. Cell lines were established in vitro from 6 chrysotile- and 7 erionite-induced rat pleural mesotheliomas. Each cell line was composed of several cell populations that were heterogeneous in their chromosome make-up, but a predominant cell population was readily recognizable in each cell line based on chromosome number. The cell lines were characterized by either aneuploid or pseudodiploid cells with chromosome modal numbers ranging from 40-92. Karyotype analyses revealed a heterogeneous display of chromosome rearrangements. Each cell line had unique abnormalities. No recurrent abnormality could as yet be associated with either chrysotile or erionite-induced mesothelioma cells. However, frequent anomalies of chromosome No. 1 suggest chromosome No. 1 involvement in the pathogenesis of rat pleural mesotheliomas.

13667 **(PB—89-125041/XAB) Interim procedures for estimating risks associated with exposures of mixtures of chlorinated dibenzo-p-dioxins and -dibenzofurans (CDDS and CDFS).** Bellin, J.S.; Barnes, D.G. (Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment). Mar 1987. 59p. (EPA—625/3-87/012). NTIS, PC A04/MF A01.

As part of its effort to address risks posed by chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans (CDDs and CDFs) in the environment, the U.S. Environmental Protection Agency (EPA) has adopted an interim procedure, based on dioxin toxicity equivalence factors (TEFs), for estimating the hazard and dose-response of complex mixtures containing CDDs and CDFs in addition to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). The TEF procedure, and the scientific data upon which it is based, are the subject of the report. The document describes the recommended interim procedure for generating the TCDD equivalence of complex mixtures of CDDs and CDFs, based on congener or homologue-specific data, and for using such information in assessing risk.

13668 **(PB—89-129050/XAB) Pulmonary-function studies in the rat addressing concentration versus time relationships of ozone (O_3).** Costa, D.L.; Hatch, G.E.; Highfill, J.; Stevens, M.A.; Tepper, J.S. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). Nov 1988. 13p. (EPA—600/D-88/256). NTIS, PC A03/MF A01.

Recent data from human studies suggest that the current 1-hr National Ambient Air Quality Standard (NAAQS) for O_3 may not be appropriate for exposures of several hours. Animal studies are being used to further investigate this issue. A polynomial model has been developed to depict lung injury from the interaction of O_3 concentration (C) and exposure duration (T). The model was derived from lung-fluid protein values in rats exposed in a matrix design to 0.1 to 0.8 ppm O_3 for 2, 4, or 8 hrs. Airway dysfunction was correlated only at the highest CxT products. Rats, exposed to 0.5 or 0.8 ppm O_3 for 2 or 7 hours with intermittent 8% CO_2 to augment ventilation, were evaluated with static and dynamic lung function tests. Protein leakage into the airspace was also assessed. Although, the impact of T on O_3 toxicity appeared to be C-dependent, loss of function was not necessarily linear. Collectively, studies provide a preliminary basis for the evaluation of duration of exposure on the pulmonary response to O_3.

13669 **(PB—89-851885/XAB) Toxicity of aromatic polycyclic hydrocarbons. January 1978-December 1987 (Citations from the Life Sciences Collection data base). Report for January 1978-December 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 181p. NTIS PC N01/MF N01.

See also PB—89-851893.

This bibliography contains citations concerning the toxicity and biochemical effects of aromatic polycyclic hydrocarbons. Topics include effects on metabolism and liver activity, cellular responses, binding characteristics, and the occurrence and path of the compounds in food chains. Bioaccumulation studies in specific areas, and isolation and detection techniques are also considered. (This updated bibliography contains 360 citations, none of which are new entries to the previous edition.)

13670 **(PB—89-851893/XAB) Toxicity of aromatic polycyclic hydrocarbons. January 1988-December 1988 (Citations from the Life Sciences Collection data base). Report for January 1988-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 35p. NTIS PC N01/MF N01.

Supersedes PB—88-855168. See also PB—89-851885.

This bibliography contains citations concerning the toxicity and biochemical effects of aromatic polycyclic hydrocarbons. Topics include effects on metabolism and liver activity, cellular responses, binding characteristics, and the occurrence and path of the compounds in food chains. Bioaccumulation studies in specific areas, and isolation and detection techniques are also considered. (This updated bibliography contains 52 citations, all of which are new entries to the previous edition.)

13671 **(PB—89-852099/XAB) Toxicity of nickel. January 1974-December 1988 (Citations from Pollution Abstracts). Report for January 1974-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 74p. NTIS PC N01/MF N01.

This bibliography contains citations concerning the toxicity, carcinogenicity, environmental pollution, and other hazards and adverse effects of nickel and nickel compounds. Management and control of nickel-containing wastes in marine, freshwater, and terrestrial environments are presented. Topics include effects of nickel on laboratory and aquatic animals, nickel in drinking water, workers exposure to nickel, nickel removal by drugs, effects of temperature and salinity on nickel toxicity, metal interactions, food contamination, and effects of nickel on agricultural crops. (Contains 156 citations fully indexed and including a title list.)

13672 **(PNL—6768) Inhalation developmental toxicology studies: Teratology study of acetone in mice and rats: Final report.** Mast, T.J.; Evanoff, J.J.; Rommereim, R.L.; Stoney, K.H.; Weigel, R.J.; Westerberg, R.B. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 366p. NTIS, PC A16/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005671/JAW.

Acetone, an aliphatic ketone, is a ubiquitous industrial solvent and chemical intermediate; consequently, the opportunity for human exposure is high. The potential for acetone to cause developmental toxicity was assessed in Sprague-Dawley rats exposed to 0, 440, 2200, or 11000 ppm, and in Swiss (CD-1) mice exposed to 0,

440, 2200, and 6600 ppm acetone vapors, 6 h/day, 7 days/week. Each of the four treatment groups consisted of 10 virgin females (for comparison), and ~32 positively mated rats or mice. Positively mated mice were exposed on days 6-17 of gestation (dg), and rats on 6-19 dg. The day of plug or sperm detection was designated as 0 dg. Body weights were obtained throughout the study period, and uterine and fetal body weights were obtained at sacrifice (rats, 20 dg; mice, 18 dg). Implants were enumerated and their status recorded. Live fetuses were sexed and examined for gross, visceral, skeletal, and soft-tissue craniofacial defects. 46 refs., 6 figs., 27 tabs.

13673 **(UBA-FB—86-046) Research project for restabilization of damaged forest ecosystems.** Krieter, M. and others. (Mainz Univ. (Germany, F.R.). Geographisches Inst.; Umweltbundesamt, Berlin (Germany, F.R.)). Dec 1986. 194p. (In German). Umweltbundesamt, Berlin (Germany, F.R.).

In the course of the reserach project concerned with the restabilization of damaged forest ecosystems two new methods of fertilization were applied on two stands of pine as well as on two stands of spruce. The one method being a surface fertilization with Ca-/MgCo3 in the form of pellets, the other being a fertilization of the subsoil with a probe pressing line into the soil. The 1984/85 research program examined the effects of these measures on soil chemistry, soil solution, fine root development, reproduction of spruces, microbe activity, the chemistry of (pine) needles and radial growth. The results are: The pellet-fertilization only influenced the ph-values in the humus-layer, not in the mineral soil. In the humus-layer an increased occupancy of the cation exchangers by Ca- and Mg-ions (exchangeable with NH4Cl) could be proved. The probe fertilization led to a distinct rise of the Ca-concentration of the exchangers connected with an increased Al-fixation. The fertilization neither caused a shock reaction nor a sudden biological activity especially in the initial phase. This was proved by measurements of the CO2-exhalation being an indicator of microbe activity in the humus-layer. (orig.) With 209 refs., 53 tabs., 73 figs.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 13026, 13335

13674 **(AD-A—200061/0/XAB) Compilation of 1987 annual reports of the Navy ELF (extremely low frequency) Communications System Ecological Monitoring Program. Volume 1. Annual progress report No. 6, January-December 1987.** (IIT Research Inst., Chicago, IL (USA)). Aug 1988. 696p. (IITRI-E—6595-2-VOL-1). NTIS, PC A99/MF E04.
See also Volume 2, AD-A200 142.

This is the sixth compilation of annual reports for the Navy's ELF Communications System Ecological Monitoring Program. The reports document the progress of ten studies performed during 1987 at the Wisconsin and Michigan Transmitting Facilities. The purpose of the monitoring is to determine whether electromagnetic fields produced by the ELF Communications System will affect resident biota or their ecological relationships.

13675 **(AD-A—200125/3/XAB) Strategy for understanding noise-induced annoyance. Final report, 1 January-29 September 1987.** Fidell, S.; Green, D.M.; Schultz, T.J.; Pearsons, K.S. (BBN Labs., Inc., Canoga Park, CA (USA)). Aug 1988. 121p. (BBN—6337). NTIS, PC A06/MF A01.

This report provides a rationale for development of a systematic approach to understanding noise-induced annoyance. Two quantitative models are developed to explain 1) the prevalence of annoyance due to residential exposure to community noise sources; and 2) the intrusiveness of individual noise events. Both models deal explicitly with the probabilistic nature of annoyance, and assign clear roles to acoustic and nonacoustic determinants of annoyance. The former model provides a theoretical foundation for empirical dosage-effect relationships between noise exposure and community response, while the latter model differentiates between the direct and immediate annoyance of noise intrusions and response bias factors that influence the reporting of annoyance. The assumptions of both models are identified, and the nature of the experimentation necessary to test hypotheses derived from the models is described.

13676 **(AD-A—200142/8/XAB) Compilation of 1987 annual reports of the avy ELF (extremely low frequency) communications System Ecological Monitoring Program. Volume 2. Annual progress report No. 6, January-December 1987.** (IIT Research Inst., Chicago, IL (USA)). Aug 1988. 382p. (IITRI-E—6595-2-VOL-2). NTIS, PC A17/MF A01.
See also Volume 3, AD-A200 143.

This is the sixth compilation of annual reports for the Navy's ELF Communications System Ecological Monitoring Program. The reports document the progress of ten studies performed during 1987 at the Wisconsin and Michigan Transmitting Facilities. The purpose of the monitoring is to determine whether electromagnetic fields produced by the ELF Communications System will affect resident biota or their ecological relationships.

13677 **(AD-A—200143/6/XAB) Compilation of 1987 annual reports of the Navy ELF (extremely low frequency) Communications System Ecological Monitoring Program. Volume 3. Annual progress report No. 6, January-December 1987.** (IIT Research Inst., Chicago, IL (USA)). Aug 1988. 481p. (IITRI-E—06595-2-VOL-3). NTIS, PC A21/MF A01.
See also Volume 1, AD-A200 061.

This is the sixth compilation of annual reports for the Navy's ELF Communications System Ecological Monitoring Program. The reports document the progress of ten studies performed during 1987 at the Wisconsin and Michigan Transmitting Facilities. The purpose of the monitoring is to determine whether electromagnetic fields produced by the ELF Communications System will affect resident biota or their ecological relationships.

13678 **(AD-A—200528/8/XAB) Research on the ocular effects of laser radiation. Executive Summary. Final report, September 1987-February 1988.** Zuclich, J.A.; Glickman, R.D.; Varner, D.C.; Koesnik, W.D.; Brakefield, J.C. (Krug International, San Antonio, TX (USA). Technology Services Div.). Sep 1988. 29p. NTIS, PC A03/MF A01.

The objective of this research was to evaluate the bioeffects of laser radiation in order to quantify threats, primarily losses of visual function (transient or permanent) that might affect performance during critical phase of military operations. Results were also applied to evaluating current laser safety standards and identifying the need for additional safety criteria. The Executive Summary is presented in seven parts dealing with the effects of laser exposures on vision via one or more of the following approaches: electrophysiological measures of visual function degradation; psychophysical measures of visual function degradation; quantitative evaluation of observable ocular damage; and predictive modeling of laser radiation interactions with the eye and with visual performance. Also included is an Appendix, which lists the publications and presentations generated as a result of this contract.

13679 **(AD-A—200538/7/XAB) Thermal responses to 5.6-GHz radiofrequency radiation in anesthetized rats. Effect of chlorpromazine.** Jauchem, J.R.; Frei, M.R.; Heinmets, F. (School of Aerospace Medicine, Brooks AFB, TX (USA)). 1988. 10p. (USAFSAM-JA—87-55). NTIS, PC A02/MF A01.

Pub. in Physiological Chemistry and Physics and Medical NMR, Vol. 20, 135-143(1988).

Anesthetized rats were exposed to 5.6-GHz continuous-wave radiofrequency radiation (RFR) at an average power density of 60 mW/Sq. cm (average specific absorption rate 12 W/kg). Exposure was performed to raise colonic temperature from 38.5 to 39.5°C. Following acute administration of chlorpromazine, body temperature exhibited a faster return to baseline temperature when exposure was discontinued. When exposure was initiated at 38.5°C and continued until lethal temperature resulted, chlorpromazine-treated animals exhibited significantly shorter survival times than saline-treated animals. Thus, although chlorpromazine enhanced thermoregulatory efficiency at colonic temperature below 39.5 deg C, the drug caused increased susceptibility to terminal RFR. The present results, when compared with previous studies of irradiation at 2.8 GHz, indicate that the effects of chlorpromazine on thermal response to RFR during intermittent and terminal exposure are similar at both 2.8 and 5.6 GHz.

13680 **(PB—89-126163/XAB) Measurement of environmental noise under different weather conditions.** Johasson, H.G. (Statens Provningsanstalt, Boraes (Sweden)). 1988. 71p. (In Swedish). NTIS, PC E04/MF A01.

Also pub. as Naturvardsverket Rapport 3437, and ISBN-91-620-3437-5.

In the Nordic countries measurements of environmental noise from industrial plants are to be carried out under strictly defined meteorological conditions. Thus, the number of possible measurement opportunities is restricted. The aim of this investigation was to find ways to increase the number. Measurements and theoretical considerations indicate that this is possible by increasing the height above the ground of the measurement microphone and to take the height of the sound source into account. The microphone height required will depend on the height of the sound source, the measurement distance, and the radius of curvature of the sound rays. For low source heights it is recommended to measure at 10 m above the ground and then to calculate the 2 m value by subtracting the difference between the calculated 10 m value and the calculated 2 m value according to the official Nordic prediction model. The proposals are verified by some field measurements.

13681 **(PB—89-852123/XAB) Acoustic noise reduction. January 1970-November 1988 (Citations from the US Patent data base). Report for January 1970-November 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 89p. NTIS PC N01/MF N01.

This bibliography contains citations of selected patents concerning methods, devices, and materials for acoustic-noise reduction. Included are noise-reduction techniques for engines, turbines, machinery, motor vehicles, pumps, aircraft cabins, and compressors. (Contains 189 citations fully indexed and including a title list.)

13682 **(PB—89-853295/XAB) Noise control for motor vehicles. January 1970-December 1988 (Citations from the NTIS data base). Report for January 1970-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Jan 1989. 134p. NTIS PC N01/MF N01.

Supersedes PB—88-850045.

This bibliography contains citations concerning methods and equipment used to control noise generated by motor vehicles. Although emphasis is placed on noise-control studies of trucks, automobiles, buses, and motorcycles are considered as well. Tire noise and specific vehicle demonstration projects are discussed. (This updated bibliography contains 219 citations, 14 of which are new entries to the previous edition.)

13683 **(AD-A—199948/1/XAB) Peoples Republic of China national standard: Laser Radiation Occupational Health Standard.** (Air Force Systems Command, Wright-Patterson AFB, OH (USA). Foreign Technology Div.). 5 Oct 1988. Trans. of Laser Radiation Occupational Health Standard (China), 6 un nr 1-18(1986). (FTD-ID(RS)T—0603-88). 29p. NTIS, PC A03/MF A01.

As far as the long-term exposure to laser radiation of a certain strength by laser workers is concerned, it is possible for it to give rise to reductions in visual acuity, clouding of lenses, as well as headaches, anemia, nerve weakness, and other similar bad effects throughout the entire body. The potentially problem-causing laser radiations are capable of leading to severe acute disorders. Because of this, personnel in contact with lasers (exclusive of those receiving laser diagnosis and treatment) should receive strengths of radiation that are definitely limited. The maximum permissible amounts of radiation (or degree of radiation) are not only related to wavelength, but also, have a close relationship with the duration of the radiation received. The maximum permissible amounts of radiation for the human body (MPE) take the two organs of the eyes and the skin as the standards.

13684 **Nonlinear optical protection against frequency agile lasers.** McDowell, V.P. (to Dept. of the Navy, Washington, DC (USA)). US Patent Application 7-228,215. 4 Aug 1988. 24p. NTIS, PC A03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

An eye-protection or equipment-filter device for protection from laser energy is disclosed. The device may be in the form of a telescope, binoculars, goggles, constructed as part of equipment such as image intensifiers or range designators. Optical elements focus the waist of the beam within a nonlinear frequency-doubling crystal or nonlinear optical element or fiber. The nonlinear elements produce a harmonic outside the visible spectrum in the case of crystals, or absorb the laser energy in the case of nonlinear fibers. Embodiments include protectors for the human eye as well as filters for sensitive machinery such as TV cameras, FLIR systems or other imaging equipment.

58 GEOSCIENCES

13685 **(DOE/ER—0397) Summaries of physical research in the geosciences.** (USDOE Office of Energy Research, Washington, DC. Engineering and Geosciences Div.). Dec 1988. 142p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005499/JAW.

The Department of Energy supports research in the geosciences in order to provide a sound foundation of fundamental knowledge in those areas of the geosciences which are germane to the Department of Energy's many missions. The Division of Engineering and Geosciences, part of the Office of Basic Energy Sciences of the Office of Energy Research, supports the Geosciences Research Program. The participants in this program include Department of Energy laboratories, industry, universities, and other governmental agencies. These activities are formalized by a contract or grant between the Department of Energy and the organization performing the work, providing funds for salaries, equipment, research minerals, and overhead. The summaries in this document, prepared by the investigators, describe the scope of the individual programs. The Geoscience Research Program includes research in geology, petrology, geophysics, geochemistry, solar physics, solar-terrestrial relationships, aeronomy, seismology, and natural resource modeling and analysis, including their various subdivisions and interdisciplinary areas. All such research is related either directly or indirectly to the Department of Energy's long-range technological needs.

13686 **(IAEA-TECDOC—472) Geological data integration techniques. Proceedings of a technical committee meeting held in Vienna, 13-17 October 1986.** (International Atomic Energy Agency, Vienna (Austria)). Sep 1988. 389p. (CONF-8610449—). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW.

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

The objectives of this Technical Committee are to bring together current knowledge on geological data handling and analysis technologies as developed in the mineral and petroleum industries for geological, geophysical, geochemical and remote sensing data that can be applied to uranium exploration and resource appraisal. The recommendation for work on this topic was first made at the meeting of the NEA-IAEA Joint Group of Experts on R and D in Uranium Exploration Techniques (Paris, May 1984). In their report, processing of integrated data sets was considered to be extremely important in view of the very extensive data sets built up over the recent years by large uranium reconnaissance programmes. With the development of large, multidisciplinary data sets which includes geochemical, geophysical, geological and remote sensing data, the ability of the geologist to easily interpret large volumes of information has been largely the result of developments in the field of computer science in the past decade. Advances in data management systems, image processing software, the size and speed of computer systems and significantly reduced processing costs have made large data set integration and analysis practical and affordable. The combined signatures which can be obtained from the different types of data significantly enhance the geologists ability to interpret fundamental geological properties thereby improving the chances of finding a significant ore body. This volume is the product of one of a number of activities related to uranium geology and exploration during the past few years with the intent of bringing new technologies and exploration techniques to the IAEA Member States.

13687 (IAEA-TECDOC—472, pp 9-18) **Experiences with database management systems for regional reconnaissance and mineral resource data.** Wurzer, F.; Kuerzl, H. (Joanneum Research Society, Leoben (Austria). Mineral Resources Research Div.). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

Presently the main task of the Mineral Resources Research Division (MRRD), Leoben, Styria, is to collect, store and process regional geological information related to the Austrian territory. Working on government contract all available data per 1:50000 mapsheet are systematically gathered and digitized. The aim is to establish a consistent digital data processing and documentation system able to provide individual information to the public. For this purpose an elegant way of data integration supported by a database management system (DBMS) is necessary. Different geological, geochemical, and geophysical data as well as facts concerning the mineral inventory, mining history, claims and a bibliography shall be incorporated in the system. Data types and structures are manifold and require special handling by the DBMS. Different approaches were tested, like hierarchical structured flat file management as for example supported by the VAX/VMS operating system, index sequential file structures, and relational DBMS like GRASP. Additionally VAX-DSM an interpreter language, which supports a highly structured hierarchical storage system is in extensive use. While with this language it is possible to develop a good working system for handling alphameric information especially for bibliographic and mineral inventory data, GRASP has reasonable abilities to deal with point related numeric data. The applicability of commercially offered geographic information systems is examined. Recent results of the investigation suggest a combination of different DBMS's, each especially suited to the respective data structure. Well defined interfaces have to be designed to support convenient transfer and link of data. 5 refs, 2 figs, 1 tab.

13688 (IAEA-TECDOC—472, pp 19-32) **Adaptation of the relational model to large volume geoscience databases.** Holroyd, M.T. (Dataplotting Services Inc., Don Mills, Ontario (Canada)). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

Over the last half decade, the Relational model has become the preferred model for Data Base Management System (DBMS) design and the Hierarchical model has come to be regarded as obsolete. The very large volume data sets from geophysical surveys are, however, intrinsically hierarchical - in both their data structures and in the data manipulation requirements of the digital compilation and cartography processes. Converting an interpolated map grid from its conventional form to a normalised relation, would (at least) double the data storage volume and (at least) quadruple the data access time. With only moderately sized surveys this is an unacceptable penalty. The relational model does, however, have distinct advantages over its predecessors in its clarity and simplicity of data definition and in the rigor with which data manipulation operations can be specified. These advantages could be of substantial benefit to geoscience data processing if the attendant disadvantages could be overcome. One means to accomplish this is to employ an Algebraic data structure model in conjunction with the Relational model. The Algebraic model treats relational domains as vectors. It too employs a rigorous formal definition of data structure and manipulation processes. The relationships between domains in the same relation and between different relations are defined by arithmetical operators used in a logical sense. The data base can thus be described by an algebraic expression and data manipulation processes can exactly be modelled by algebraic manipulation of this expression. The addition of the Algebraic model overcomes the above noted disadvantages of the Relational model as it permits Geoscience data sets to be viewed externally as fully normalised relations yet treated internally in their conventional, condensed form. (author). 8 refs.

13689 (IAEA-TECDOC—472, pp 33-50) **SAMINDABA - A South African mineral deposits database.** Hine, S.S.; Hammerbeck, E.C.I. (Geological Survey of South Africa, Pretoria (South Africa)). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

The South African Mineral Deposits database, SAMINDABA, is designed specifically to accommodate interactive computerized access to data on known mineral deposits within the Republic of South Africa. Data on a wide range of mineral deposits is being captured at present, interalia on uranium deposits of the Karoo Sequence. The mineral deposit data is subdivided into seven major groupings: DEPOSIT IDENTIFICATION DATA identifying and locating the mineral deposit; HOST ROCK DATA a multiple data grouping describing the host rock(s) surrounding the ore body(ies); OREBODY DATA a multiple data grouping describing the geological characteristics of the orebody(ies); EXPLORATION DATA describing the history and level of exploration carried out on the mineral deposit; EXPLOITATION DATA RESOURCE DATA describing deposit resources sub-divided into the following subgroups: demonstrated economic reserves, demonstrated marginal reserves, demonstrated subeconomic resources, and inferred resources and, finally, DATA REFERENCES describing references to the sources of the mineral deposit data. SAMINDABA'S primary functions include the capture, validation and updating of the mineral deposit data while at the same time maintaining a high level of security. Enquiries on and extraction from the database can be done on two levels, firstly using an on-line, menu driven enquiry system, SAMENQ, which allows a user, no matter what his level of computer expertise, to make enquiries using predefined search paths, key fields and output formats. The second level requires a specialized knowledge of the database structure but allows a user freedom to enquire and output the enquiry results in any format that he wishes. A facility was created in SAMENQ allowing a user to output the results of an enquiry to an interface file for input to various application packages as required. These, at present, include statistical, graphical, mapping and modelling packages. (author). 7 refs, 9 figs.

13690 (IAEA-TECDOC—472, pp 51-60) **GEOSIS - A pilot study of a geoscience spatial information system.** Currie, A.L. (Ontario Geological Survey, Toronto (Canada)). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

GEOSIS is a database system for geoscience and exploration data designed to cover Ontario. A pilot study is currently in progress to test all aspects of GEOSIS (eg data input methods for cost and throughput, data structures, response rates and user interface). The pilot study area (80km by 20km) is in north-western Ontario just north of Lake St Joseph, and is part of the Uchi belt. The major data sets within the database are Precambrian geology and economic geology (ie assessment files, mineral occurrences data etc) with subsidiary data sets such as remote-sensing data. GEOSIS is designed so that users can access the database using a telecommunicating microcomputer without any decrease in functionality compared to a directly connected graphics workstation. Spatial information systems are based on the concept of spatial relationships (ie map data) and attributes of objects on maps. Data structures used in GEOSIS must be able to successfully integrate several fundamentally different kinds of data: 1. structured map graphic data (geoscience maps), 2. passive raster graphics (sketch maps from field notes and property descriptions), 3. raster data from remote sensing or image processing systems, 4. structured alphanumeric data (geological structural data) and 5. unstructured text (geologists' reports, property descriptions etc). The goal of the GEOSIS project is to provide users, in their place of work (office or field), with access to the geoscience data collected or managed by the Ministry of Northern Development and Mines. (author). 1 fig.

13691 (IAEA-TECDOC—472, pp 245-272) **Graphical displays of multivariate geochemical data on scatterplots and maps as an aid to detailed interpretation.** Kuerzl, H. (Joanneum Research Society, Leoben (Austria). Mineral Resources Research Div.). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

Geological data analysis is currently undergoing major changes. It seems crucial to collect as many data as possible and to consider several variables at a time to uncover geological processes with their inherent complexities and peculiarities. Diverse relative complex multivariate mathematical/statistical methods have been used, leading however, quite often to results, where interpretation was extremely difficult. One reason is that the strong parametric models based on certain assumption, generally implied in these methods, are not always valid for empirical data. A new way of looking at data is suggested by the so called "Exploratory Data Analysis" techniques. They include resistant order statistics, robust statistics and a variety of relatively simple graphical methods. Basically they refer to the univariate case, which should never be neglected before looking at the relationships and common characteristics of two or more variables together. Graphical methods especially for analysing multivariate data use symbolic scatterplots and multiple code symbols. The construction of the symbols and the different possibilities of graphical displays are explained. In examples using a set of multivariate data, derived from the regional stream sediment survey of Austria, different multiple code symbols will be compared and the possibility of identifying patterns and relationships will be demonstrated. By looking at several multivariate displays the inherent data structure can be uncovered. In some cases a distinct aid to interpretation and essential additional informations for further classical numerical statistical analyses can be gained. 13 refs, 19 figs, 1 tab.

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 12628, 12638, 12640, 12721, 13571, 13699, 13700

13692 (CBPF-NF—016/88) **Dating by thermoluminescence of some costal sand deposits of last climatic cycle, from the northeastern region of Rio Grande do Sul State, Brazil.** Poupeau, G.; Rivera, A.; Soliani Junior, E.; Loss, E.L.; Vasconcellos, M.B.A. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ; Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Geociencias; Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. 29p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705008/JAW.

Six coastal quartz sand deposits from the northeastern region of the Rio Grande do Sul State (Brazil), with reasonably well known ages, from {similar←to} 1700 yr to {similar←to} 120.000 yr, were dated by thermoluminescence. (M.W.O.).

13693 (DOE/MC/21129—2646) **Kinematics of the mosquito terrane, Coldfoot Area, Alaska: Keys to Brooks Range tectonics: Final report, Project No. 2.** Harms, T.A.; Coney, P.J. (Arizona Univ., Tucson (USA). Dept. of Geosciences). Apr 1988. Contract AC21-84MC21129. 25p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000907/JAW.

Within the large-scale geometry of the Brooks Range, the Angayucham terrane occurs as a vast overthrust sheet. From the north flank of the Ruby terrane it underlies the Koyukuk basin and stretches north as the roof thrust to the various nappe terranes of the Brooks Range. The tectonic relationship of the Ruby terrane to the south flank of the Brooks Range lies largely obscured beneath the Angayucham in the eastern apex of the Koyukuk basin. The Mosquito terrane occurs as a window through the Angayucham at this juncture. The composition and structures of the Mosquito terrane reveal that is the result of shear along a sub-horizontal step or flange within the prominent, through-going dextral strike-slip fault system which cuts across the eastern Koyukuk basin and southeastern Brooks Range. Units of the Mosquito were derived from both the Angayucham and Ruby terranes. A consistent tectonic fabric imposed upon them is kinematically linked to the strike-slip system and indicates a northeasterly direction of transport across the terrane. The presence of Ruby-correlative units within the Mosquito suggests the Ruby underlies the Angayucham and that it is in contact with terrances of the southern Brooks Range at that structural level along high-angle strike-slip faults. These relationships demonstrate that an episode of dextral transpression is the latest in the history of terrane accretion and tectonic evolution of the Brooks Range. 35 refs.

13694 (EGG-M—88473) **Decreasing sampling costs by increasing statistical efficiency through geostatistics: A case study.** Ferns, T.W.; Ariss, C.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 11p. (CONF-8811122—5). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005314/JAW.

From 13. annual environmental quality R and D symposium; Williamsburg, VA, United States (16 Nov 1988).

The INEL (Idaho National Engineering Laboratory) conducted a post- mortem examination of a dioxin cleanup study having a data base of over 2000 sampling points. The result of the post-mortem study was that approximately 60% of the sampling and analysis budget could have been saved, had geostatistics been used in the sampling design. Additionally, the final product of the sampling plan would have had greater utility at the site closure negotiations because of the reliability map uniquely generated through a technique known as "kriging." We feel that kriging is an important cost saving tool which should be utilized more often in Installation Restoration Program (IRP) work. Directional variograms showing data anisotropy and sample planning information are shown. Maps delineating the dioxin isopleths and areal variances are also presented. 13 refs., 4 figs., 1 tab.

13695 (IAEA-TECDOC—472, pp 339-355) **ADP-system to predict massive Cu-Zn ore deposits using maps of different scales.** Kuosmanen, V.V.; Arkimaa, H.M.; Suppala, I.A. (Geologinen Tutkimuslaitos, Espoo (Finland)). Sep 1988. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88705255/JAW. (CONF-8610449—).

From Technical committee meeting on geological data integration techniques; Vienna, Austria (13 Oct 1986).

This work is a part of the geodata integration project in the Exploration Department of the Geological Survey of Finland. The purpose of the project is mainly to develop methods for prediction of especially massive Cn-Zn ore deposits. The basic idea of this work is that large ore deposits may be generated only by large geological processes due to large tectonic events. Indications of large geological structures and formations are therefore seen in reconnaissance scale geophysical, geochemical, etc. maps and remote sensing data. These are used to predict large areal favourability for ore deposits. But in order to properly predict field targets for exploration, geomaps and predictions in regional scale are needed simultaneously with the reconnaissance studies. An ADP-system, composed of two main programs LOCUS and SCALEX, was designed to study map data of various 'scales' for prediction purposes. These programs were applied to geodata on a 330x420 km/sup 2/ large test area and included two smaller, 60x75 and 30x50 km/sup 2/ areas. All the areas are situated on the Archean-Early Proterozoic 'Main Sulphide Ore Belt' which contains 90% of the known sulphide ore reserves in Finland. The data consisted of gravimetric, magnetic and soil geochemical measurements and maps on Cu-Zn ore deposits in the reconnaissance scale and low altitude geophysical survey data such as magnetic, electromagnetic measurements and mineralization maps in the regional scale. All geophysical and geochemical data were gridded into pixel-image form. Spatial frequencies of the geodata were enhanced in order to find structurally relevant combinations of different variables, e.g. to correlate maps of different spatial resolutions. These data were studied both visually and statistically in feature spaces (= variable spaces). It was found that features of ore deposits (from big to small) followed certain subspaces in these multidimensional feature spaces. (Abstract Truncated)

13696 **(INIS-BR—1345) Litiniferous pegmatites from Itinga-Aracuai region, Minas Gerais, Brazil.** Silva Sa, J.H. da. (Sao Paulo Univ., SP (Brazil). Inst. de Geociencias). 1977. 123p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705144/JAW.

This work explains the study of more a hundred pegmatites from Itinga and Aracuai, in middle Jequitinhonha. This area have cassiterite, tantalite-columbite, semiprecious stones ad lithium minerals. The lithium ores are the most economic importance. The predominate rocks are quartz-mica schist, rich in cordierite. Geochronological dating, by the Rb-Sr method, show ages about 650 m.a. to schist and 520 m.a. to the granites. Was dated muscovites from two pegmatites by K-Ar method showing ages about 4677+- 18 m.a and 490 +- 12 m.a. The pegmatites was classified in simple and complex, based in mineralogical and structural criterion. In the complex pegmatites was determinated notable accessory minerological association, in which the principal are lithium ores-petalite, spodumene, lepidolite, ambligonite, the cesium ore-polucite-and cassiterite, tantalite-columbite, and great variety of turmaline. Genetically the pegmatites are related with the granites of this region, with present high tenor of the lithium, cesium and beryllium, comparate with the normal granites. (C.D.G.).

13697 **(NUREG/CR—5277) The tensorial nature of effective porosity and large-scale dispersion coefficients: Application to the Creston study area, Eastern Washington.** McKee, C.R.; Way, S.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; In-Situ, Inc., Laramie, WY (USA)). Dec 1988. 55p. NTIS, PC A04/MF A01 - GPO - OSTI. Order Number TI89005752/JAW.

To describe flow in a complex system of fractures requires an understanding of the effects of direction or orientation on several hydrologic characteristics, such as hydraulic conductivity, porosity, and dispersion coefficient. The theory for hydraulic conductivity is well understood; this report deals with the effects of fracture orientation on porosity and dispersion coefficient. The tensorial nature of effective porosity was examined and was found to be a second-rank tensor in fractured rock units. Porosity varies at a fixed point, depending on its orientation. A method to calculate a dispersion coefficient from field tracer tests is described. The components of the dispersion coefficient can be calculated from the concentration profiles observed in downgradient observation wells. The method provides a procedure for studying the dispersion effect in large-scale field testing. The application of this method was successfully demonstrated in a tracer test performed in the research wellfield at the Creston study area, Lincoln County, Washington.

13698 **(SKB-TR—87-21) Hydrochemical investigations in crystalline bedrock in relation to existing hydraulic conditions: Klipperaas test-site Smaaland, Southern Sweden.** Smellie, J.; Larsson, N.Aa.; Wikberg, P.; Puigdomenech, I.; Tullborg, E.L. (Swedish Geological Company, Uppsala (SE); Royal Inst. of Tech., Stockholm (SE); Studsvik Energiteknik AB, Nykoeping (SE); Swedish Geological Company, Goeteborg (SE)). (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Sep 1987. 123p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756203/JAW.

This report of the Klipperaas test-site area has been structured to allow a full discussion of all the component procedures employed during the study, and to evaluate their respective use in such a site specific programme. For example, the suitability of the sampled groundwaters, in terms of representative compositions for the hydrogeological environment sampled, are thoroughly assessed before their use in the geochemical modelling procedures. The major hydrologic and chemical parameters considered for the Klipperaas area are similar to those previously described for the other sites. Respectively, these parameters referred to: (1) hydraulic conductivity and hydraulic head,(2) the pH and carbonate contents of the groundwaters, (3) the sodium, calcium and chloride contents of the groundwaters,(4) the groundwater redox-sensitive parameters, (5) the uranium geochemistry, and (6) the environmental isotopic characteristics of the groundwaters. For the Klipperaas site area additional borehole measurements using tubewave and radar techniques have been carried out, and the application of geochemical modelling to the groundwater data has been attempted. (With 40 refs.) (authors).

5802 Geophysics

REFER ALSO TO CITATION(S) 12637, 12639, 12718, 12719, 13471, 13693

13699 **(DOE/MC/21129—2645) A structural analysis of the Sylvester Allochthon, British Columbia, and interpretations for unconventional, deep-source gas potential in accreted terrane domains: Final report, Project No. 1.** Harms, T.A.; Coney, P.J. (Arizona Univ., Tucson (USA). Dept. of Geosciences). Nov 1987. Contract AC21-84MC21129. 63p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000906/JAW.

Presented here are the results of new detailed mapping, paleontologic sampling and structural analysis in a study area in the Sylvester Allochthon. This work expands the present understanding of the nature and history of the Sylvester Allochthon and re-addresses paleogeographic interpretations of the Slide Mountain Terrane. The work reported here will show that the Sylvester assemblage comprises oceanic rock types ranging in age from Late Devonian to Late Triassic. As mapped, complex lithologic juxtapositions demonstrate that the Sylvester "stratigraphy" is tectonic; the internal structural style of the allochthon can be characterized as a nested stack of interleaved lithotectonic slices. The Sylvester Allochthon will be correlated not only with the Slide Mountain Terrane, but also with similar terranes in the Brooks Range in Alaska and with the Golconda Allochthon in Nevada, to show that together these terranes represent the telescoping of a vast amount of Paleozoic ocean floor. Newly recognized imbricate structures in underlying North American strata are described. Generation of these structures will be correlated with obduction-related deformation. Finally, the structural style of the Sylvester Allochthon, and of underlying autochthon deformation, along with the character of the terrane obduction process, will be evaluated in terms of their implications toward the potential for unconventional deep-source gas resources in accreted terrane domains.

13700 **(DOE/MC/21129—2647) Provenance and petrofacies, Upper Devonian sandstones, Philip Smith Mountains and Arctic quandrangles, Brooks Range, Alaska: Final report, Project No. 3.** Anderson, A.V.; Coney, P.J. (Arizona Univ., Tucson (USA). Dept. of Geosciences). Nov 1987. Contract AC21-84MC21129. 81p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000908/JAW.

Late Devonian sandstone beds are exposed as allochthonous sequences that extend for over 1000 km along the east-west strike of the Brooks Range in northern Alaska. These horizons, at least in part, record Late Devonian tectonism and deposition along the southern margin of the Arctic Alaska block. This study identifies clastic petrofacies in the western Philip Smith Mountains and southern Arctic quadrangles and infers the composition of the source terrane. The paleogeography is not known and the original distribution of lithofacies is uncertain, owing to the extensive post-depositional tectonism. In the study area the sandstones are exposed along rugged mountain tops and high ridges. Although exposures are excellent, access is often difficult. Samples were collected from exposures near the western end of the Chandalar Shelf, Atigun Pass, and the Atigun River valley in the Philip Smith Mountains quadrangle and from the Crow Nest Creek and Ottertail Creek areas in the Arctic quadrangle. 34 refs., 17 figs.

13701 **(NUREG/CR—5258-Vol.1) Georgia/Alabama regional seismographic network: Annual report, August 1985--June 1986.** Long, L.T. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Georgia Inst. of Tech., Atlanta (USA). School of Geophysical Sciences). Dec 1988. 41p. NTIS, PC A03/MF A01 - GPO - OSTI. Order Number TI89005374/JAW.

Earthquakes in southeastern Tennessee were analyzed using a velocity gradient crustal model. S-P times were used to first compute origin time independent of location. Then the epicenter was found using the standard methods. Depth was computed alternately with the epicenter in order to use different weights for the depth

computation. Weights and partial derivatives of the travel time were based on the velocity gradient crustal model. With this technique, all events were relocated and examined for consistent traveltime residuals. Significant residuals of about 0.2 s were observed at stations near a sedimentary basin. Preliminary analysis of focal mechanisms suggests that earthquakes in the most active zone in southeastern Tennessee are consistently strike slip and at depths of 15 to 20 km. Earthquakes in the surrounding area are shallower and often show significant components of normal or reverse movement. This suggests that the central area reacts directly to regional plate stress, whereas the surrounding earthquakes occur on existing planes of weakness. Seismic activity near Lake Sinclair and Richard B. Russell Lake was also studied. A few of the events near Richard B. Russell Lake appear to have been induced by filling of this lake.

13702 **(UCID—21464) Results of a seismic scattering study using data from Long Valley and Medicine Lake, California.** Doll, W.E.; Zucca, J.J. (Lawrence Livermore National Lab., CA (USA)). 20 Jul 1988. Contract W-7405-ENG-48. 55p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006076/JAW.

Many recent papers have stressed the importance of scattered waves in seismic data. Some have used finite differences models to demonstrate that scattering might provide simple explanations for unusual observations. Others have characterized the subsurface by a statistically defined heterogeneity in order to explain coda decay, travel time variations, or other observations. Reflection seismologists have continued to develop migration techniques for locating scattering sources. Few studies have attempted to locate sources of scattering with small or sparse arrays, or three-component data. That is the subject of this study. Often, seismologists use first arrival times to determine the velocity structure of portions of the earth's crust. These include refraction experiments and some tomography experiments. In many cases, the only analysis that is performed on these data sets is the modeling of first arrival times and amplitudes, and perhaps modeling of a few large secondary arrivals. The resulting structures often include some very sharp boundaries with strong velocity contrasts. Where there are abrupt changes in the velocity structure, we expect to see strong scattered waves in addition to the reflected and refracted waves that most seismic analysis methods detect. These signals would come in after the first arrivals and might be indistinct because of their low amplitudes. In an attempt to identify such waves, we have applied a method that images scatterers to data collected in regions where there are large lateral changes in velocity. A major objective of this study was to provide confirmation as well as a better location for anomalous features that had been identified by other methods. 17 refs., 23 figs., 1 tab.

13703 **(UCRL—99769) Low frequency electromagnetic cross-borehole imaging.** Pihlman, M.; Harben, P.E. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 14p. (CONF-890243—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89001922/JAW.

From International symposium on enhanced oil recovery; Maracaibo, Venezuela (19 Feb 1989).

Most of the research in cross-borehole electromagnetic (EM) imaging has been done at high frequencies (17 to 200 Mhz). At these frequencies, the propagation distance through-the-earth is limited to less than 8 meters and the attenuation of the signal depends on a complex combination of the earth's conductivity and permittivity. Because of the effect of conductivity and permittivity on the attenuation, the images obtained are difficult to interpret. In this paper, we show that use of frequencies below 2 Mhz theoretically increases the propagation distance through-the-earth, and that the signal attenuation is primarily effected by the earth's conductivity. We developed a new low-frequency cross-borehole electromagnetic system operating between 100 khz and 2 Mhz to see if we could actually transmit 30 meters with an electric dipole antenna. The results of these field trips demonstrated that the electric dipole method of cross-borehole transmission is not feasible for transmission distances of practical interest (30 meters or more) in enhanced oil recovery (EOR) applications. 5 refs., 12 figs.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 13696

13704 **(SAND—88-2108C) Complete computer simulation of crater blasting including fragmentation and rock motion.** Preece, D.S.; Taylor, L.M. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 13p. (CONF-890252—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005608/JAW.

From Society of Explosive Engineers spring research meeting; New Orleans, LA, USA (5 Feb 1989).

Computer simulation of the physics involved in conventional rock blasting can be split into two phases; transient stress wave propagation and rock motion. Because the two phases involve totally different mechanisms and time scales, they might numerically modeled with two different computer programs. The first phase is usually modeled with a finite element or finite difference code which treats the rock as a continuum and simulates the transient stress wave and subsequent fragmentation of the rock. The second phase is usually modeled with a distinct element technique where the rock mass after fragmentation is no longer treated as a continuum but as a finite number of distinct particles that interact with each other through collision mechanics. In the past, data has been transferred manually from the transient stress wave code to the rock motion code. Manual data transfer has proven to be a long, laborious process that greatly limits the number of simulations that can be made. In order to make blasting simulations routine, the transfer of information has to be done automatically by the computer. The tasks involved in automatic transfer of information include: (1) conversion of the finite element mesh into a distinct element (spheres) mesh that contains fragmented and unfragmented regions and where the sphere size in the fragmented regions reflects the fragment size distribution calculated by the transient wave code, (2) correctly interpolate the transient wave induced residual velocity from the finite element mesh to the distinct element mesh. A new computer program called DMC (Distinct Motion Code) has been developed to calculate rock motion using a spherical element mesh. The major advantage of DMC over previous codes is computational efficiency. An example problem is presented where a crater geometry is simulated through the entire blasting process including the transient stress wave phase and the rock motion phase. 8 refs., 11 figs., 2 tabs.

5804 Geochemistry

REFER ALSO TO CITATION(S) 12641, 12701, 13707

5805 Oceanography

REFER ALSO TO CITATION(S) 13488, 13586

13705 **(DOE/ER—0402) Coastal ocean margins program.** (Department of Energy, Washington, DC (USA). Office of Health and Environmental Research). Dec 1988. 44p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005937/JAW.

The marine research program supported by the Office of Energy Research, Ecological Research Division, is focused to provide scientific information on major environmental issues facing development and expansion of most energy technologies and energy policy. These issues include waste disposal, siting/operations, and possible long term effects on global systems. The research is concentrated along the United States coastal margins where marine waters provide abundant food and resources while assimilating discharges from atmospheric, terrestrial, and aquatic sources. The program focuses on the formation and transport of particles within the waters of the continental shelf and the fate of these particles, whether on the shelf, on the slope, or in the open ocean. The program is conducted with multidisciplinary teams of researchers who investigate water mass movements, biological productivity, and naturally forming particles, as well as contaminant transport, to develop a clear understanding of the exchanges of contaminants and

other materials that take place between continental shelf and open ocean waters. Seventy-five percent of the projects are funded to university grantees and twenty-five percent to National Laboratories.

13706 **(DOE/ER/60338—5) Program of mineralization and cycling in marine systems: Organic geochemistry of particulates and sediments (CaBS): Progress report, November 15, 1987--November 14, 1988.** Venkatesan, M.I.; Kaplan, I.R. (California Univ., Los Angeles (USA). Inst. of Geophysics and Planetary Physics). Nov 1988. Contract FG05-85ER60338. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005045/JAW.

The biogeochemical processes and the dynamics involved in the cycling and transport of organic carbon can be elucidated only by determining distributions of specific organic compounds associated with the particles. At UCLA, the quantitative data of the various organic compounds in the sediment cores and trap particulates from various depths of water column are gathered in order to construct a dynamic model of the biogeochemical cycling and processes occurring in the water and sedimentary columns. The sources of organic carbon in southern California Bight derive from both terrestrial and marine regimes. The varied organic carbon sources can be reasonably delineated within limits by the organic geochemical approach of determining various characteristic biomarkers, as well as a variety of pollution indicators. The distributions of organic biomarker compounds are characteristic of marine algae, terrestrial vascular plants, bacteria, etc. Presence of specific biomarkers also indicate the occurrence of specific species (e.g., dinosterol specific of dinoflagellates). There are some pollution indicators which one can look for in the marine environment to trace their origin to terrestrial inputs, i.e., polycyclic aromatic hydrocarbons from petroleum and combustion, coprostanol from sewage, etc. We study the distribution of many of these compounds and from a correlation of their relative abundance, an atten.pt is made to delineate marine vs terrestrial influx to the organic carbon in the study area. 18 refs., 1 fig., 4 tabs.

13707 **(DOE/ER/60450—T2) Coordination: Southeast continental shelf studies: Progress report.** Menzel, D.W. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). 26 Jan 1989. Contract FG09-86ER60450. 32p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006091/JAW.

The principal investigator, David Menzel, is responsible for coordinating activities associated with the conduct of research, sponsored by DOE, on the oceanography of the southeastern continental shelf. These activities include: (1) serving as a contact between program managers at DOE and principal investigators associated with the program, (2) developing and implementing long-range research plans, (3) providing DOE with summaries of the results of past and current research activities, (4) conducting planning/reporting meetings involving principal investigators and interested agency personnel, and (5) consolidating and scheduling the use of research vessels. 202 refs.

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REFER ALSO TO CITATION(S) 13458, 13733, 13734, 13736, 13797

13708 **(AD-A—199774/1/XAB) Dynamical properties of solar current loops with line-tied footprints: effects of toroidal forces. Interim report.** Chen, J. (Naval Research Lab., Washington, DC (USA)). 25 Aug 1988. 41p. (NRL-MR—6256). NTIS, PC A03/MF A01.

The effects were studied of toroidal forces in current loops embedded in an ambient plasma such as the corona. These forces occur in current-carrying plasmas with curvature. The model loop is characterized by twisted magnetic-field lines. The magnetic field and current density have toroidal and poloidal components. A current loop was assumed to evolve while maintaining a half-torus configuration. The important geometrical constraint that footpoints are generally immobile on the relevant time scales was not taken into account. The dynamical properties of current loops similar to those of the earlier work are examined with the requirement that the footpoints remain stationary in the photosphere. The behavior of the present, more-realistic model is qualitatively similar to that of the earlier model. In particular, the velocities the apex can achieve under the action of toroidal forces and the magnetic energy released in the form of drag heating are similar in their respective magnitudes. In this calculation, the ratio eta of the height of the apex and the footpoint separation is a physical parameter. It is found that a low-lying loop (small eta) can evolve to a taller (larger eta) loop in a quasi-equilibrium fashion if the current is increased slowly while holding the footpoint separation fixed. Time evolution of the loops and the magnetic energy converted via drag heating are presented. Results are also presented for loops with relatively strong current. It appears that the toroidal forces can lead to a wide range of plasma motion. The accompanying drag heating can take place with a correspondingly wide range of rates.

13709 **(AD-A—200018/0/XAB) Evidence for regions of negligible cosmic-ray modulation in the inner heliosphere (< 10 AU).** Roelof, E.C. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). 1985. 5p. NTIS, PC A02/MF A01.

Observations are reported on extended regions of heliolongitude that emitted lower-than-average solar-wind velocities at 1 AU and also exhibited higher-than-average cosmic-ray intensities as measured by the E > 35-MeV CPME anti-coincidence scintillator (28 sq cm omnidirectional geometric factor) on IMP-8. Their observations can be reproduced by a simple model, based on the observed steady solar-wind structure, wherein there is little modulation of cosmic rays in the inner heliosphere until they reach the shocked plasma beyond the stream interactions in the outer heliosphere (about 5-10 AU). Beyond the interaction boundary, the intensity exhibits a constant radial gradient (about 2%/AU). The model also offers an explanation for the irregular behavior of the rotation-averaged radial gradients observed by inside 10 AU, as well as the significant, but often ephemeral, latitude gradients observed by Voyagers 1 and 2 and IMP-8.

13710 **(AD-A—200019/8/XAB) Diffusion coefficients of low-energy protons upstream of quasi-parallel interplanetary shocks.** Van Nes, P.; Roelof, E.C.; Reinhard, R.; Sanderson, T.R.; Wenzel, K.P. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). 1984. 5p. NTIS, PC A02/MF A01.

Pub. in Advanced Space Research, Vol. 4, 315-318(1984).

The diffusion coefficient for low-energy protons upstream of three interplanetary shocks were observed on ISEE-3. The intensity increase as the shock approaches can be fitted by a running exponential, the e-folding time t* of which is assumed to be a direct measure of the diffusion coefficient. The energy dependence of t* close to the shock (0-60 R/sub e/) is derived from the four energy channels covering the range 35-238 keV. The t* in the low-energy channels (less than 100 keV) increases with distance away from the shock. However, t* decreases above 100 keV and roughly beyond 100 Re so that the diffusion coefficient becomes independent of energy. We suggest that the energy independence of t* in a region well upstream of the shock is the result of enhanced parallel scattering through 90^0 pitch angles for higher energy (larger gyroradius) particles which are more sensitive to variations in the transverse direction of the magnetic field.

13711 **(AD-A—200020/6/XAB) Three-dimensional gradients of solar particles inside 5 AU.** Roelof, E.C. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). 1986. 11p. NTIS, PC A03/MF A01.

Pub. in The Sun and the Heloosphere in Three Dynamic, 331-340(1986).

The spatial gradients (field-aligned, longitudinal, and latitudinal) in solar-flare energetic-particle events are described in terms of their occurrence in the three phase of the event (rise, maximum, and decay). The information that can be derived from these phases is discussed in the context of the Ulysses mission.

13712 **(AD-A—200021/4/XAB) Gradients and anisotropies of high-energy cosmic rays in outer heliosphere.** Walker, F.; Roelof, E.C.; Smith, E.J.; Wood, D.; Ip, W.H. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). 1985. 5p. NTIS, PC A02/MF A01.

Pub. in Proceedings of the International Cosmic Ray Conference, CP5, 1-4(1985).

Two cosmic rays which pass through the same point going in opposite directions will, in the absence of scattering and inhomogeneities in the magnetic field, trace helices about adjacent flux tubes, whose centerlines are separated by one gyrodiameter. A directional anisotropy at the point suggests a difference in the number of cosmic rays loading the two flux tubes; that is, a density gradient over the baseline of a gyrodiameter. Previous studies at lower energies have shown that the cosmic-ray density gradients vary in space and time, and many authors currently are suggesting that the radial gradient associated with solar-cycle modulation is supported largely by narrow barriers that encircle the sun and propagate outward with the solar wind. If so, the anisotropy is a desirable way to detect spatial gradients, because it can be associated with the local solar wind and magnetic-field conditions. The anisotropy measurements made by the UCSD Cerenkov detectors on Pioneers 10 and 11 are studied. The local anisotropy varies greatly, but the long-term average is consistent with the global radial gradient measured between two spacecraft over a baseline of many AU.

13713 **(AD-A—200022/2/XAB) Effect of the ionosphere on C3I systems.** Akasofu, S.I. (Alaska Univ., Fairbanks (USA). Geophysical Inst.). 3 May 1988. 16p. NTIS, PC A03/MF A01.

Pub. in Ionospheric Effects Symposium, 263-275(3 May 1984).

Geomagnetic and auroral disturbances cause significant interference on communications, navigation, and radar systems. Therefore, it is essential to develop a geomagnetic and auroral storm prediction scheme which can provide necessary information in evaluating the interference well before a major geomagnetic storm. The prediction of auroral disturbances and of the F-layer trough development is especially significant for the operation of HF systems at mid and high latitudes. For these reasons, the author has been developing a practical numerical prediction scheme, that can predict storm characteristics, oval diameter, and trough parameters with a 6-12 hour lead time.

13714 **(AD-A—200253/3/XAB) Massive symbolic mathematical computations and their applications. Quarterly report, 1 May-31 July 1988.** Chudnovsky, D.V.; Chudnovsky, G.V.; Friedman, M.B.; Prendergast, K. (Columbia Univ., New York (USA)). 16 Aug 1988. 5p. (TR—2). NTIS, PC A02/MF A01.

Development is continued on codes solving large-scale realistic models of aero-, hydrodynamic, and astrophysical problems on fast vector and parallel versions of three-dimensional of aero- and hydrodynamics codes, tested by us on a variety of two-dimensional problems. These codes are used now for solutions of astronomical, astrophysical, and cosmological problems. The main part of the code development is the reduction of its computational complexity, to make it feasible to run in a moderate time (days of super-computers) large simulations of galaxy evolution over a large fraction of Hubble time. For this purpose we use symbolic computational methods and computer algebra programs and tools, developed by us. Particularly successful was the development of specialized fast (scalar, vector, and parallel) subroutines of evaluation of special functions and their integrals in the astrophysical code (needed for computation of chemical, thermodynamical, and gravitational effects), that consume most of the runtime of the programs. Our algorithms for special function evaluations are based on our fast methods of power series and rational approximation computations.

13715 **(BNL—52084) Relativistic jets and the most powerful radio sources in the universe.** Bridle, A. (Brookhaven National Lab., Upton, NY (USA)). 20 May 1987. Contract AC02-76CH00016. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005980/JAW.

Relativistic jets, which are beams of particles and magnetic fields emitting synchrotron radiation that emanate from black holes at the centers of galaxies and quasars, have been one of the most exciting discoveries made at the Very Large Array (VLA) operated by the National Radio Astronomy Observatory (NRAO). The VLA is an array of 27 antennas, each 25 meters in diameter, distributed in a Y-formation with two branches 21 kilometers long and one branch 19 kilometers long. Astronomers can use it to study relativistic jets that generate intense natural radio sources (or transmitters). These sources, associated with regions hundreds of thousands of light years across, are the most powerful in the universe in energy output. In his lecture, Bridle describes how consecutive advances in imaging techniques for radio astronomy have uncovered the properties of the powerful radio sources, culminating in the discovery at the VLA that many of these sources contain radio emitting jets. He then describes some of the NRAO's research on these jets, and discusses the jets' physical properties. He concludes with an outlook for the future: the NRAO's Very Long Baseline Array (VLBA) is to be completed in the early 1990's. The VLBA is an array of ten radio telescopes distributed from Hawaii to St. Croix, from the Canadian border to Texas. With the VLBA, astronomers plan to look more deeply into these radio sources. 15 figs.

13716 **(DOE/ER/10587—6) Particle physics and cosmology, Task C: Progress report, January 1987--January 1989.** Turner, M.S. (Chicago Univ., IL (USA)). Jan 1989. Contract AC02-80ER10587;AC02-76ER03130. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005790/JAW.

Topics covered in this paper are: Pedagogy; Non-topological solitons; Axions and SN 1987 A; Superconducting cosmic strings; and Dark matter detection. 31 refs. (LSP)

13717 **(FRNC-TH—3302) Gamma rays, tracers of the interstellar medium and messengers of pulsars and other energetic objects.** Grenier, I. (Paris-7 Univ., 75 (France)). Mar 1988. 269p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88756676/JAW.

Gamma radiation observed in our Galaxy by the COS-B satellite was studied. The interstellar medium was studied at large scale using the fact that diffuse gamma rays are created by the interaction of cosmic rays with any interstellar matter and comparisons with different tracers and star and galaxy counts. Ground-based maps of molecular clouds were also used. Bright compact gamma sources were also analyzed. Results include the detection in Co of a distant spiral arm of the Galaxy (15kpc) and an important molecular complex nearby (300pc); the first Co survey of the Galaxy; measurement of the NH2/WCo ratio and week galactic gradients of cosmic rays; the high energy behavior of the Vela pulsar; the detection of a gamma source; and the discovery of a large supernova remnant which exploded 300pc from the Sun 40,000 years ago.

13718 **(IC—88/91) Black holes as possible sources of closed and semiclosed worlds.** Frolov, V.P.; Markov, M.A.; Mukhanov, V.F. (AN SSSR, Moscow. Fizicheskij Inst.). (International Centre for Theoretical Physics, Trieste (Italy)). May 1988. 38p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705336/JAW.

The internal structure of spacetime inside a black hole is investigated on the assumption that some limiting curvature exists. It is shown that the Schwarzschild metric inside a black hole can be attached to the de Sitter one at some spacelike junction hypersurface which represents a short transition layer. After passing the deflation stage the de Sitter space inside the black hole begins to inflate and may become a source of a new macroscopic Universe. The corresponding conformal Penrose diagrams are given. The described model may be considered as an example of "a creation of a closed or semiclosed world in laboratory". The fate of an evaporating black hole is also briefly discussed. (author). 21 refs, 12 figs.

13719 (IPPJ—863, pp 47-58) **MHD simulation of the solar wind and cometary plasma. An MHD model with plasma production.** Ogino, T.; Walker, R.J.; Ashour-Abdalla, M. (Nagoya Univ. (Japan). Research Inst. of Atmospherics). Mar 1988. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780049/JAW. (CONF-8703311—).

From 2. U.S.-Japan workshop on advanced plasma modeling; Nagoya, Japan (23 Mar 1987).

Interaction between the solar wind and the plasmas produced from cometary gases has been modeled by using a three-dimensional time-dependent magnetohydrodynamic (MHD) simulation with the cometary mass loading. The model reproduced several features observed by the recent missions to comet Halley. A weak bow shock was located at 3.2 x 10/sup 5/ km in front of the comet. The magnetic field increased by a factor of 3.7 across this weak bow shock and continued to increase up to the contact surface (B/sub max//B/sub IMF/ = 6 {similar←to} 8). The plasma temperature increased across the bow shock and decreased nearer to the comet. IMF lines were hung up on the comet and formed a long plasma tail in which the lobe field was quite strong and B/sub lobe//B/sub IMF/ {similar←to} 5. A cold dense plasma sheet formed in the tail and this thin plasma sheet was oriented normal to the IMF direction.

13720 **(N—89-12366) Axions and SN1987A.** Burrows, A.; Turner, M.S.; Brinkmann, R.P. (Fermi National Accelerator Lab., Batavia, IL (USA)). Sep 1988. 26p. (NASA-CR—183368; NAS—1.26:183368; FERMILAB-PUB—88/105-A). NTIS, PC A03/MF A01.

The effect of free-streaming axion emission on numerical models for the cooling of the newly born neutron star associated with SN1987A is considered. It is found that for an axion mass of greater than approximately 10 to the -3 eV, axion emission shortens the duration of the expected neutrino burst so significantly that it would be inconsistent with the neutrino observations made by the Kamiokande II and Irvine-Michigan-Brookhaven detectors. However, the possibility has not been investigated that axion trapping (which should occur for masses greater than or equal to 0.02 eV) sufficiently reduces axion emission so that axion masses greater than approximately 2 eV would be consistent with the neutrino observations.

13721 **(N—89-12367) Cosmological structure formation from soft topological defects.** Hill, C.T.; Schramm, D.N.; Fry, J.N. (Fermi National Accelerator Lab., Batavia, IL (USA)). Sep 1988. 17p. (NASA-CR—183371; NAS—1.26:183371; FERMILAB-PUB—88/120-A). NTIS, PC A03/MF A01.

Some models have extremely low-mass pseudo-Goldstone bosons that can lead to vacuum phase transitions at late times, after the decoupling of the microwave background.. This can generate structure formation at redshifts z greater than or approx 10 on mass scales as large as M approx 10 to the 18th solar masses. Such low energy transitions can lead to large but phenomenologically acceptable density inhomogeneities in soft topological defects (e.g., domain walls) with minimal variations in the microwave anisotropy, as small as delta Y/T less than or approx 10 to the minus 6 power. This mechanism is independent of the existence of hot, cold, or baryonic dark matter. It is a novel alternative to both cosmic string and to inflationary quantum fluctuations as the origin of structure in the Universe.

13722 **(N—89-12474) Effects of ordinary and superconducting cosmic strings on primordial nucleosynthesis.** Hodges, H.M.; Turner, M.S. (Fermi National Accelerator Lab., Batavia, IL (USA)). Aug 1988. 22p. (NASA-CR—183366; NAS—1.26:183366; FERMILAB-PUB—88/115-A). NTIS, PC A03/MF A01.

A precise calculation is done of the primordial nucleosynthesis constraint on the energy per length of ordinary and superconducting cosmic strings. A general formula is provided for the constraint on the string tension for ordinary strings. Using the current values for the various parameters that describe the evolution of loops, the constraint for ordinary strings is G mu less than 2.2 x 10 to the minus 5 power. Our constraint is weaker than previously quoted limits by a factor of approximately 5. For superconducting loops, with currents generated by primordial magnetic fields, the constraint can be less or more stringent than this limit, depending on the strength of the magnetic field. It is also found in this case that there is a negligible amount of entropy production if the electromagnetic radiation from strings thermalizes with the radiation background.

13723 **(N—89-12510) Interstellar lines in the spectrum of supernova 1987a. Final report, period ending 14 September 1988.** Jenkins, E.B.; Joseph, C.L. (Princeton Univ., NJ (USA)). Oct 1988. 60p. (NASA-CR—183222; NAS—1.26:183222). NTIS, PC A04/MF A01.

The primary interest was to analyze the interstellar lines produced by gases along the line of sight which resides in the galactic plane and halo, as well as material in the Large Magellanic Cloud or the immediate environment of the supernovae. The ionization and fine-structure excitation of assorted atoms were intrepreted. The goal was to learn more about conditions in various regions of space and identify the probable origins for some velocity components whose locations were uncertain.

13724 **(N—89-12513) Atlas of galaxies useful for measuring the cosmological distance scale.** Sandage, A.; Bedke, J. (National Aeronautics and Space Administration, Washington, DC (USA)). 1988. 462p. (NASA-SP—496; NAS—1.21:496; LC—88-600056). NTIS, PC A20; also available SOD HC $80.00 as 033-000-01020-6.

A critical first step in determining distances to galaxies is to measure some property of primary objects such as stars of specific types, H II regions, and supernovae remnants that are resolved out of the general galactic star content. With the completion of the Mount Wilson/Palomar/Las Campanas survey of bright galaxies in 1985, excellent large-scale photographs of the complete Shapley-Ames sample were on hand. Most of the galaxies useful for distance scale calibration are in this collection. This atlas contains photographs of 322 galaxies including the majority of all Shapley-Ames bright galaxies, plus cluster members in the Virgo Cluster core that might be usefully resolved by the Hubble Space Telescope (HST). Because of crowding and high background-disk surface brightness, the choice of field position is crucial for programs involving resolution of particular galaxies into stars. The purpose of this atlas is to facilitate this choice. Enough information is given herein (coordinates of the galaxy centers and the scale of the photography) to allow optimum placement of the HST wide-field planetary camera format of approximately 150 arc-seconds on a side.

13725 **(N—89-12524) Cross Sections, relic abundance, and detection rates for neutralino dark matter.** Griest, K. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1988. 53p. (NASA-CR—183362; NAS—1.26:183362; FERMILAB-PUB—88/74-A). NTIS, PC A04/MF A01.

Neutralino annihilation and elastic scattering cross sections are derived which differ in important ways from previous work. These are applied to relic abundance calculations and to direct detection of neutralino dark matter from the galactic halo. Assuming the neutralino to be the lightest supersymmetric particle and that it is less massive than the Z sup 0, we find relic densities of neutralinos greater than 4 percent of critical density for almost all values of the supersymmetric parameters. We constrain the parameter space by using results from PETRA (chargino mass less than 23 GeV) and ASP, and then assuming a critical density of neutralinos, display event rates in a cryogenic detector for a variety of models. A new term implies spin independent elastic scattering even for those majorana particles and inclusion of propagator momenta increases detection rates by 10 to 300 percent for pure photinos. Z sup 0-squark interference leads to very low detection rates for some values of the parameters. The new term in the elastic cross section dominates for heavy, mostly spinless materials and mitigates the negative interference cancellations in light materials; except for the pure photino or pure higgsinos cases where it does not contribute. In general, the rates can be substantially different from the pure photino and pure higgsino special cases usually considered.

13726 **(N—89-12529) Collaborative analysis of solar maximum mission, Venera and Prognoz solar x-ray bursts. Semiannual report, February-July 1988.** Hurley, K.C. (California Univ., Berkeley (USA)). Oct 1988. 10p. (NASA-CR—183258; NAS—1.26:183258). NTIS, PC A02/MF A01.

Efforts centered on cross-calibrating the Solar Maximum Mission (SMM) HXRBS detector with the Venera 13/14 cosmic ray burst detectors. The event was divided into six time intervals, and the best fitting SMM and Venera 13 spectra were calculated

for each interval, using the individual fitting routines for the two instruments. The results are presented and discussed.

13727 **(N—89-12530) Modelling of solar magnetic field and prominence structures. Final report, 1 October 1986-30 September 1988.** Wu, S.T. (Alabama Univ., Huntsville (USA)). Oct 1988. 131p. (NASA-CR—183306; NAS—1.26:183306). NTIS, PC A07/MF A01.

Using plasma theory, the interaction is studied between high frequency and magnetohydrodynamic (MHD) waves, from which a set of coupling equations resulted. On the basis of this formalism, the modulation instabilities of an electromagnetic soliton in a current sheet are examined, and it is shown that there is a resistive instability at the onset of the magnetic field reconnection. This mechanism could be used to explain the onset of solar flares and prominences. To improve the resolution of vector magnetic fields at the sun's surface, state-of-the-art optics is examined to improve the design and fabrication of a new spaceborne solar vector magnetograph as part of the SAMEX (Solar Active Measurements Experiment) program.

13728 **(N—89-13375) Theoretical studies of mass loss and shock phenomena in cool star envelopes. Semiannual progress reports No. 9 and 10, 1 October 1987-30 September 1988.** Hartmann, L. (Smithsonian Astrophysical Observatory, Cambridge, MA (USA)). Sep 1988. 17p. (NASA-CR—182708; NAS—1.26:182708). NTIS, PC A03/MF A01.

Wind-disk interactions; disks in T Tauri stars; and T Tauri stars in the HR diagram are examined.

13729 **(RAL—88-039) Abundances in the diffuse interstellar medium.** Harris, A.W. (Rutherford Appleton Lab., Chilton (UK)). Apr 1988. 15p. (CONF-8804199—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754963/JAW.

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The wealth of interstellar absorption line data obtained with the Copernicus and IUE satellites has opened up a new era in studies of the interstellar gas. It is now well established that certain elements, generally those with high condensation temperatures, are substantially under-abundant in the gas-phase relative to total solar or cosmic abundances. This depletion of elements is due to the existence of solid material in the form of dust grains in the interstellar medium. Surprisingly, however, recent surveys indicate that even volatile elements such as Zn and S are significantly depleted in many sight lines. Developments in this field which have been made possible by the large base of UV interstellar absorption line data built up over recent years are reviewed and the implications of the results for our understanding of the physical processes governing depletion are discussed.

13730 **(RAL—88-053) Flare activity on UV CETI: visible and IUE observations.** Phillips, K.J.H.; Bromage, G.E.; Dufton, P.L.; Keenan, F.P.; Kingston, A.E. (Rutherford Appleton Lab., Chilton (UK); Queen's Univ., Belfast, Northern Ireland (UK)). (Rutherford Appleton Lab., Chilton (UK)). Jun 1988. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754965/JAW.

Accepted for publication in Mon. Not. R. Astron. Soc.

Simultaneous far-ultraviolet (IUE) spectroscopy and optical photometry and spectrophotometry of a flare on UV Ceti are reported. The flare reached $\Delta U = 2sup(m)$ but showed only modest enhancements in the IUE spectra. The optical spectrophotometry indicated broadened Balmer line profiles during the flare, with Hβ and Hγ clearly showing red wings. The results are compared with other IUE and optical observations of UV Ceti, and their solar analogues.

13731 **(UCRL—53809-87) Institute of Geophysics and Planetary Physics at Lawrence Livermore National Laboratory: Annual report, July 1, 1986--June 30, 1987.** Max, C.E. (ed.). (Lawrence Livermore National Lab., CA (USA)). 8 Jul 1988. Contract W-7405-ENG-48. 117p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006017/JAW.

This report contains papers on the following main topics: Geoscience, High-pressure sciences, and Astrophysics. (LSP)

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REFER ALSO TO CITATION(S) 13990

13732 **(AD-A—199623/0/XAB) University of New Hampshire vacuum chamber and charged-particle calibration source. Final report, 1 November 1986-31 May 1988.** Arnoldy, R.L. (New Hampshire Univ., Durham (USA)). Jul 1988. 15p. NTIS, PC A03/MF A01.

This grant provides partial support for the purchase and fabrication of a vacuum-chamber facility to be used in the calibration of electron and ion detectors. The detectors are space-flight instruments that will be flown aboard sound rockets and future shuttle missions to study the physics of charged-particle-beam emission in the upper ionosphere and the dumping of trapped radiation by low-frequency radio transmitter and lightning strokes.

13733 **(AD-A—199777/4/XAB) NRL (Naval Research Laboratory) data base of oblique-incidence soundings of the ionosphere. Interim report, February 1986-March 1988.** Goodman, J.M.; Daehler, M. (Naval Research Lab., Washington, DC (USA)). 20 Sep 1988. 47p. (NRL-MR—6337). NTIS, PC A03/MF A01.

The Naval Research Laboratory has participated in a number of field exercises in support of HF communications, HF Direction Finding (HFDF), and HF Single-Site-Location (HF-SSL) systems development since 1980. During these exercises, the NRL support has included the documentation of ionospheric channel information through collection of Oblique-Incidence-Sounding (OIS) data. Data was obtained over two distinct epochs of solar activity. The first group, obtained between 1980 and 1982, was obtained for a period of high solar activity. The second group of data obtained between 1986 and the present, corresponds to relatively low or moderate activity. This report describes a collection of approximately 167,000 ionograms in terms of the environmental conditions under which they were obtained. It is planned to make these data sets available as a resource to qualified researchers.

13734 **(AD-A—200008/1/XAB) Polar-cap diurnal temperature variations: observations and modeling.** McCormac, F.G.; Killeen, T.L.; Burns, A.G.; Meriwether, J.W.; Roble, R.G. (Michigan Univ., Ann Arbor (USA). Space Physics Research Lab.). 1 Jul 1988. 14p. NTIS, PC A03/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 93, No. A7, 7466-7477(1 Jul 1988).

A diurnal variation in thermospheric temperature in the geomagnetic polar cap at solar minimum (Jan 87) was observed using high spectral-resolution measurements of the O(1D) emission line made with the Fabry-Perot interferometer located at Thule, Greenland. Data from the wind and temperature spectrometer on the Dynamics Explorer 2 satellite show a diurnal variation in the northern polar cap thermospheric temperature for near-solar-maximum conditions. The diagnostics package, developed for use with the NCAR thermospheric general circulation model (TGCM), allows the tracking of individual parcels of gas in both time and space by interpolation through the model grid. Each loci of the parcels influences the thermal balance by decomposing the thermodynamic equation into its constituent terms. Tracing the trajectory of a parcel backward in time and space from the location of Thule (i.e., well inside the geomagnetic polar cap), will show, for a model run with input parameter near the solstice pertaining to day 314, 1976 (i.e., several weeks from solstice near solar minimum), that near the solstice that observed diurnal temperature variation is attributable to the following factors: (1) the degree of solar heat input that a parcel experiences en route to the polar cap, which is dependent on whether or not it crosses the solar terminator, (2) the route a parcel takes through the polar cusp, i.e, whether the parcel skirts the edge or passes directly through the center determines the total quantity of heat added by soft particle impact within the crusp, (3) the time duration between maximum herat input from the combination solar, cusp, auroral, and Joule source and the time of arrival overhead at Thule.

13735 **(AD-A—200278/0/XAB) Electromagnetic tornadoes in space.** Chang, T.; Crew, G.B.; Retterer, J.M. (Massachusetts Inst. of Tech., Cambridge (USA). Center for Space Research). 1988. 15p. NTIS, PC A03/MF A01.

Pub. in Computer Physics Communications, Vol. 49, 61-74(1988).

The exotic phenomenon of energetic-ion conic formation by plasma waves in the magnetosphere is considered. Two particular transverse heating mechanisms are reviewed in detail; lower-hybrid energization of ions in the boundary layer of the plasma sheet and electromagnetic ion cyclotron resonance heating in the central region of the plasma sheet. Mean particle calculations, plasma simulations and analytical treatments of the heating processes are described.

13736 **(AD-A—200338/2/XAB) Average low-latitude meridional electric fields from DE 2 during solar maximum.** Maynard, N.; Aggson, T.; Herrero, F.; Liebrecht, M. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1 May 1988. 18p. (AFGL-TR—88-0289). NTIS, PC A03/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 93, No. A5, 4021-4037(1 May 1988).

Electric-field data from the double-probe vector electric-field instrument (VEFI) on the DE 2 spacecraft were analyzed to determine the average meridional electric-field (zonal ion flow) patterns in the region between + or - 30 deg magnetic latitude during solar maximum conditions. Over 300 passes were used to compile the data set. Data were projected to a constant 300-km altitude and to the equatorial plane assuming that the electric field along the magnetic field was zero. The average data set displayed a rapid increase of the downward meridional electric field with local time near 1800 MLT with the higher latitudes seeing the change first. A secondary nighttime maximum of this electric-field component was observed past midnight with the crossover to upward electric fields (westward ion flow) occurring between 0400 and 0500 MLT. A sharp return to near zero was observed between 1200 and 1300. Typical average amplitudes range between 3 and 6 mV/m. No consistent variations with magnetic activity were observed. Although the daily variation in the zonal ion flow is dominated by the diurnal term, a net superrotation is evident in the harmonic analysis. The superrotation is strongest near the equator and decreases with latitude, because of the disturbance dynamo. The higher order harmonics up through the quatrediurnal term are also of significant magnitude in the analysis of the shape of the daily variation. Close similarity is seen to the zonal neutral winds indicating that they form the principal driving force. The magnitudes of the electric field derived ion drift are somewhat higher than the average F-region neutral-wind values.

13737 **(AD-A—200543/7/XAB) Large-scale auroral distribution and the open-field-line region.** Murphree, J.; Anger, C.; Meng, C.I.; Akasofu, S. (Alaska Univ., Fairbanks (USA). Geophysical Inst.). 1984. 6p. NTIS, PC A02/MF A01.

Pub. in Planetary and Space Science, Vol. 32, No. 1, 105-109(1984).

An example of global auroral distribution is presented that is clearly more circular than oval and is thus fit to an offset circle. The area surrounded by the aurora is also compared with the open region constructed by a model of the open magnetosphere for the IMF condition about 1 h prior to the auroral observation.

13738 **(CBPF-NF—032/88) Meson production and Nuclear fragmentation of nucleus in the atmosphere.** Navia Ojeda, C.E.; Portella, H.M.; Pinto, H.V.; Pinto, F.A.; Maldonado, R.H.C. (Universidade Federal Fluminense, Niteroi (Brazil). Inst. de Fisica). (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. 24p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705019/JAW.

Propagation of the primary and secondary cosmic ray in the atmosphere is calculated analitically. Two different cases of primary cosmic ray composition are used; the first case concerns the mixed composition of very heavy, heavy, middle, light nuclei and nucleons; and the second case considers only nucleons in the primary cosmic ray flux. The mechanism of multiple meson production is formulated according to the wounded nucleon model for nucleus-nucleus interaction and the scaling model for nucleon-nucleon interaction. The mechanism of nuclei fragmentation is formulated according to the experimental values of the fragmentation parameters at low energy. The calculated results of the electromagnetic flux are compared with the results of mountain experiments with large scale emulsion chamber and experimental data at airplane altitude. From these comparisons the calculation of electromagnetic flux altitude variation of the first case gives the best fit with experimental data than the second case.

13739 **(HIFT—145) Spontaneous generation of auroral arcs in a three dimensionally coupled magnetosphere-ionosphere system.** Watanabe, Kunihiko; Sato, Tetsuya. (Science Project Corp., Hiroshima (Japan)). (Hiroshima Univ. (Japan). Inst. for Fusion Theory). Jan 1988. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756537/JAW.

This paper presents the first full three-dimensional dynamic simulation of auroral arc formation. The magnetospheric and ionospheric dynamics are represented by one-fluid magnetohydrodynamic equations and two-fluid weakly ionized plasma equations, respectively. The feedback coupling between magnetospheric Alfven waves and ionospheric density waves are self-consistently and three-dimensionally solved. Obtained is a spontaneous generation of longitudinally elongated striations of field-aligned currents and ionospheric electron densities, which compare very well with many features of quiet auroral arcs.

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REFER ALSO TO CITATION(S) 13255, 13270, 13392, 13775, 13777, 13907, 13908, 13948, 13954, 14022, 14047, 14048, 14050, 14051

13740 **(AD-A—200136/0/XAB) Interaction of radiation with matter: atomic-collision processes occurring in the presence of radiation fields. Report for 1 August 1987-31 July 1988.** Berman, P.R. (New York Univ., NY (USA). Dept. of Physics). 15 Sep 1988. 88p. NTIS, PC A05/MF A01.

Work is reported in areas of: 1) Laser spectroscopic line shapes; 2) Coherent transients including collisional effects; 3) Laser-assisted collisions; 4) Collision-induced resonant structures in laser spectroscopy; 5) Collision kernels and transport coefficients; 6) Interactions with broadband noise.

13741 **(AD-A—200187/3/XAB) Electron-water vapor (H_2O) collision cross sections. Interim report.** Ali, A.W. (Naval Research Lab., Washington, DC (USA)). 26 Aug 1988. 37p. (NRL-MR—6268). NTIS, PC A03/MF A01.

Water vapor (H_2O) is one of the minor constituents of the atmosphere and it plays an important role in the deionization processes of the partially ionized air. It controls the air conductivity, especially that of the the unheated air. Therefore, the role of H_2O in modifying the electron velocity distribution in wet air is required for characterizations of partially ionized wet air. This requires the solution of a Boltzmann equation with an appropriate set of electron-molecule scattering cross sections. This report, accordingly, presents a set of up to date cross sections for the electron - H_2O collisions over a wide range of electron energies. The set comprises the total, ionization, dissociative ionization, dissociative excitation, electronic, vibrational, rotational, elastic and momentum transfer cross sections.

13742 **(AD-A—200296/2/XAB) Electron-collision shift of the Lyman-alpha line in H and Hhe^{+1}. Interim report.** Blaha, M.; Davis, J. (Naval Research Lab., Washington, DC (USA)). 9 Sep 1988. 55p. (NRL-MR—6294). NTIS, PC A04/MF A01.

The interaction of plasma microfields with radiating atoms and ions causes a line broadening that governs both the half-width and shift of the spectral line, i.e., the intensity distribution in frequency is altered to reflect the presence of the plasma. The line shifts are of particular interest both for their intrinsic value in terms of providing insight into the fundamental nature of the underlying

physical processes affecting the emission of radiation as well as its diagnostic value in the study of high-density plasmas. In addition, exact wavelengths of spectral lines of highly charged ions are required in the determination of line opacities and level positions for x-ray-laser transitions. The sensitivity of spectral line shift is investigated in the impact approximation for a variety of assumptions using the distorted-wave with exchange approach. The formalism is applied to the Lyman-alpha line of hydrogen and ionized helium to determine the influence of various assumptions on the line shift as well as identifying the differences between a neutral and ionized radiator. The results are compared and contrasted with a number of other calculations and experimental measurements. (AW)

13743 **(AD-A—200373/9/XAB) Cooled-ion frequency standard. Annual report, October 1987-September 1988.** Wineland, D.J. (National Inst. of Standards and Technology (NML), Boulder, CO (USA). Time and Frequency Div.). 27 Sep 1988. 11p. NTIS, PC A03/MF A01.

The purpose of this work is to develop techniques to overcome the fundamental limits of present frequency standards - the second-order and residual first-order Doppler shifts. To this end suitable frequency reference transitions are studied in ions stored on electromagnetic traps and cooled by radiation pressure to < 1k.

13744 **(CONF-880893—2) High-precision laser and rf spectroscopy of atomic, molecular, and slow ion beams.** Childs, W.J.; Steimle, T.C.; Sen, A.; Azuma, Y. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 3p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005870/JAW.

From DOE atomic physics contractors' meeting; Bethesda, MD, USA (31 Aug 1988).

We have obtained extensive new structural information on the light diatomic radical ScO since the last report in this series. The new studies complete our systematic investigation of the fine and hyperfine structure (hfs) of the group IIIa monoxides LaO, YO, and ScO. The studies of the molecular X $^2\Sigma^+$ electronic ground state were carried out using the molecular-beam laser-rf double-resonance method, and the excited electronic state information was obtained by complementing this data with Doppler-free laser fluorescence studies.

13745 **(DOE/FTR—9005084) [Laboratory colloquium, Philips Research Laboratory, Eindhoven, Netherlands, visit to positron facility at Netherlands Energy Research Foundation (ECN), Petten, and positron beam physics in the USA, University of Delft, April 18--23, 1988]: Foreign trip report.** Lynn, K.G. (Brookhaven National Lab., Upton, NY (USA)). 25 Apr 1988. Contract AC02-76CH00016. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005084/JAW.

This trip report outlines travel to the University of Delft, Philips Research Laboratory, and the Netherlands Energy Research Foundation (ECN). The traveler presented a laboratory colloquium at Philips and visited the scientists working on the new technology for semiconductor development. The ongoing research between Philips and Brookhaven was discussed, which is involved with overlayers and interfaces of semiconductors.

13746 **(ENEA-RT-TIB—87-65) Preionization electron density measurement by collecting electric charge.** Giordano, G.; Letardi, T.; Zheng, C.E. (ENEA, Frascati (Italy). Centro Ricerche Energia; Academia Sinica, Beijing, BJ (China)). (ENEA, Rome (Italy)). 1988. 16p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705321/JAW.

A method using electron collection for preionization-electron number density measurements is presented. A cathode-potential drop model is used to describe the measurement principle. There is good agreement between the model and the experimental result.

13747 **(GSI—88-24) Angular correlations of coincident electron-positron pairs in heavy ion collisions.** Graf, O. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.)). Oct 1988. 117p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756495/JAW.

In the present thesis angular correlations of coincident electron-positron pairsnin heavy ion collisions are studied. It is meant as a contribution to the answer of fundamental questions in the quantum electrodynamics of strong fields. (orig./HSI).

13748 **(IC—88/231) Lamb shift of Rydberg atoms in a resonator.** Belov, A.A.; Lozovik, Yu.E.; Pokrovsky, V.L. (AN SSSR, Moscow. Inst. Teoreticheskoj Fiziki; AN SSSR, Troitsk. Inst. Spektroskopii). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 15p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705354/JAW.

The Lamb shift of a Rydberg atom in a cavity is shown to be enhanced with the resonance interaction of a virtual atomic transition and cavity modes. The dependence of the Lamb shift on quantum numbers and atomic number changes drastically. Shifting cavity walls and scanning the atomic beam one can vary the Lamb shift. The value of the Lamb shift in a cavity may exceed a typical magnitude of the fine structure energy. For a rough resonance tuning the Coulumb multiplet occurs to be strongly mixed and a novel classification is necessary. (author). 8 refs, 2 figs.

13749 (JINR—D-14-87-799, pp 175-182) **Muonium in condensed media.** Gordeev, V.A. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Experimental data on minimum physics, obtained in the period between the first (1977) symposium and the present one in Dubna in the LIYF synchrocyclotron muon channel by the joint LIYaF (Gatchina) and ITEP (Moscow)-BSU (Minsk) group are systematized. Time picture of μ/sup $+$/ interaction in the solid body crystal lattice is given in the modern concept of the author. As a result of systematic investigation into Mu and anomalous muonium Mu* behaviour in silicon monocrystals of n- and p-type of conductivity in Ge and diamond monocrystals in a wide temperature range using perpendicular and longitudinal magnetic field methods, Mu and Mu* state parts are ascertained. State interaction dynamics is studied, temperature regions at which transitions between states occur are ascertained. Molecular radical model verification concerning Mu and Mu* state mobility in GaAs, ZnSe is performed. 30 refs.

13750 (JINR—D-14-87-799, pp 130-138) **Static and dynamic muon polarization functions.** Meier, P.F. (Zurich Univ. (Switzerland). Inst. fuer Physik). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Some of the improved theoretical descriptions of the time evolution of polarization functions for a static muon are given. Muons and several neighbouring nuclei with spins in transverse, zero and longitudinal magnetic fields are considered. Muonium states in transverse fields are also analyzed. Muonium relaxation rates in high transverse fields also yield information about the superhyperfine and dipole interactions. 14 refs.; 4 figs.

13751 (JINR—D-14-87-799, pp 153-164) **Old and new questions in muonium chemistry and chemical physics.** Cox, S.F.J. (Rutherford Appleton Lab., Chilton (UK)). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The paper consideres the origin of the muon-proton isotope effects in hyperfine coupling and the origin of the muonium-substi-

tuted species themselves, i.e. their mechanism of formation following muon implantation. μSR and level crossing resonance methods are used to indicate the existance of muonium and muonic radicals. The new information which is available on the substituted ethyl radical CH/sub 2/xCH/sub 2/xMu and related species is discussed. The positive isotope effect for β muons and protons in organic radicals contrasted with the opposite effect found for muonium centres in ionic crystals. The muon explores the interstitial cavity more fully than the proton. Laser vibrational and laser muonium spectroscopies are suggested for determination of muonium defect centres in crystalline solid. It is stressed that the level crossing resonance method ideally complements the other μSR methods. 30 refs.; 5 figs.

13752 (JINR—D-14-87-799, pp 217-223) **Relativistic effects in muonic molecules.** Bakalov, D.D. 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Relativistic effects: spin-independent relativistic and QED effects, particle spin effects and nuclear electromagnetic structure (EMS) effects are considered in muonic molecules. All these effects give rise to some corrections to tμ atom and dtμ molecule energy levels and allow to define the Coulomb binding energy. Relativistic and EMS corrections to muonic molecule binding energy are calculated numerically with an accuracy of 10/sup -3/ eV. The main contribution to the shift of the muonic molecule binding energy Δε/sup (tot)/ comes from nuclear EMS effects. Deuteron polarizability correction Δε/sup (pol)/=-1.9 MeV is significantly smaller than in dμ atom, because of the spatial asymmetry of dtμ muonic molecule. 18 refs.

13753 (JINR—D-14-87-799, pp 268-278) **Formation and de-excitation of (μHe)/sup +/ and μp atoms.** Kottmann, F. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Hochenergiephysik). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Experimental data on the formation and de-excitation of (μHe)/sup +/ and μp atoms are presented. Such processes as slowing down, atomic capture, muonic cascade and interactions of the muonic atom in the ground state with the surrounding medium are described quantitatively. A "muon bottle" technique used for measurements on μ/sup -/p and (μ/sup -/He)/sup +/ atoms at gas pressures ranging from a few atm down to the Torr region is described. Results from from these measurements in H/sub 2/ and He gases and H/sub 2/+He mixtures with the muon bottle are given. 38 refs.; 5 figs.; 2 tabs.

13754 (JINR—D-14-87-799, pp 347-360) **Atomic muon capture and electronic structures.** Schneuwly, H. (Fribourg Univ. (Switzerland). Inst. de Physique). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Different models are suggested for analyzing the observed atomic muon rates. Data on capture probabilities and capture ratios are analyzed with account of muonic X-ray intensity patterns. The influence of chemical band in the capture of muons in compounds is shown. For compounds of very light elements, the chemical bond dominates the capture mechanism. 47 refs.; 2 figs.

13755 (JINR—D-14-87-799, pp 361-365) **Highly polarized μ/sup -/ state in polarized muonic atoms.** Nagamine, K. (Tokyo Univ. (Japan). Meson Science Lab.). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

A short summary is given of a successful realization of the repolarization method for muonic /sup 209/Bi. The highly polarized /sup 209/Bi targets were realized in a ferromagnetic compound of BiMn under 7 kG external field at 0.062 K. The obtained μ/sup -/ repolarization degree is equal to -63 (18)%. 8 refs.; 2 figs.

13756 (JINR—D-14-87-799, pp 431-436) **Thermal muonium in vacuum and possible intense ultra-slow μ/sup +/ beams.** Nagamine, K. (Tokyo Univ. (Japan). Meson Science Lab.; Tokyo Univ. (Japan). Faculty of Science). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Some details of the experimental method for observation of thermal muonium in vacuum and of a possible intense ultra-slow μ/sup +/ beam are reported. The production of the thermal energy Mu was observed in the time-of-flight spectrum obtained by a time-evolution of decay e/sup +/ intensity at different positions from the tungsten foil. Among the possible future experiments the following are now under considerations: (a) muon decay parameter measurements for the μ/sup +/ in vacuum; (b) muonium resonance spectroscopy in vacuum; (c) electronic structure studies of μ/sup +//Mu on solid-surface; (d) diffusion of the μ/sup +/ on metal surface; and (e) Mu chemical reaction on surface. 9 refs.; 3 figs.

13757 (JINR—D-14-87-799, pp 198-202) **Muonium in substance: peculiarities related to a quadrupole moment.** Baryshevskij, V.G.; Kuten', S.A.; Rapoport, V.I.; Barsov, S.G.; Gordeev, V.A. (Belorusskij Gosudarstvennyj Univ., Minsk; AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Review of muonium properties in substance related to the presence of a quadrupole moment in it is presented. In this case the situation when muonium is weakly disturbed by the lattice and is in the state close to vacuum one is only considered because in the opposite situation the experimental data interpretation in the language of muonium quadrupole interaction (QI) with lattice cannot be satisfactory. Results of experiments in α-quartz where a change of QI value and symmetry conditioned by muonium diffusion by the lattice uccures are analysed in detail. 21 refs.

13758 (JINR—D-14-87-799, pp 224-232) **Muonic HE X-rays from muon-catalyzed hydrogen fusion.** Daniel, H.; Angerer, H.; Bossy, H. and others. (6134633DE). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The paper deals with motivation of measuring He X- and γ-rays from μ-catalyzed fusion. Experimental results are reported and comparison with theory is made. The authors confined themselves to pμd, dμd and dμt. The pμt fusion is also measured. A number of methods for revitalizing the μ after atomic capture on He are proposed and all of them are based on dc field and ac field. 15 refs.; 5 figs.

13759 (JINR—D-14-87-799, pp 366-373) **2S->1S conversion process with muon transition in the electron shell of (μ/sup 4/He(2S))/sup +/He/sub n/ (n=4, 6) complexes.** Grechukhin, D.P.; Romanov, S.V.; Soldatov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The aim is to determine if the hypothesis concerning the formation of μHe/sup +/(2S)He symmetric complexes corresponds to experimental values of tau/sub 2S/(p), tau/sub 2S/(p) is the full life time of μHe/sup +/(2S) mesic ion forming in the pure helium atmosphere within the following pressure: p=7-50 atm. For this purpose a calculation of electron structure and rate of conversion E process of the muon 2S -> 1S transition on the electronic shell of possible complexes in the form of a tetrahedron and octahedron with mesic in the symmetry center is conducted. It is shown that

E0 and M1 multipoles make contribution to the muon 2S -> 1S transition amplitude. In the area of minor Z (Z-the nucleus charge) the dominant contribution to the transition amplitude is made by E0-multipole. Non-relativistic Coulomb wave functions of mesoatomic /1S >- and /2S >- orbits were used in the calculation. 26 refs.; 2 figs.

13760 (JINR—D-14-87-799, pp 374-378) **Nucleus size and hyperfine structure of light exotic atoms.** Trofimenko, E.E. (Belorusskij Politekhnicheskij Inst., Minsk). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The further specification of a correction for the finite nucleus size to the energy of hyperfine splitting (HFS) of ns-levels is analytically conducted and effect of nucleus extent on light muonic atom energy np-level HFS value is studied. With the accuracy of up to the terms of the (ZR/a/sub 0/)/sup 2/ order expressions for any spherical-symmetric charge and dipole magnetic nucleus moment distributions, are obtained. When considering np-level hyperfine structure corrections for the nuclear recoil of the m/sub μ//m order and np/sub 172/-np/sub 372/-state mixing at the expence of hyperfine interaction are taken into account. Calculation for the muon /sup 7/Li 1s-level is conducted. 10 refs.

13761 (JINR—D-14-87-799, pp 379-383) **Method for calculating vacuum polarization potential in mesic atoms for finite charge distribution in nucleus.** Borisoglebskij, L.A.; Tesevich, B.I. (AN Belorusskoj SSR, Minsk. Inst. Fiziki; Belorusskij Gosudarstvennyj Univ., Minsk). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Analytic expression for additional vacuum polarization potential V/sup VP/(r) in mesic atoms in case of arbitrary finite charge distribution in a nucleus with a marked boundary is derived. The method for vacuum e/sup +/e/sup -/-polarization potential calculation considered can be applied not only for spherical nuclei but for deformed ones as well characterized by quadrupole, hexadecapole parameters and allows one to take into account the nucleus form deviation from axial-symmetric one. 7 refs.

13762 (JINR—D-14-87-799, pp 384-388) **Muon potential in the muonic atom with accounting nonaxial nuclear deformation.** Tesevich, B.I.; Trofimenko, E.E.; Kuzhir, P.G. (AN Belorusskoj SSR, Minsk. Inst. Fiziki; Belorusskij Politekhnicheskij Inst., Minsk). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The work is aimed at calculating the potential muon energy V(r) in the non-axially deformed nucleus field, necessary for determining the energy of muon levels in the muonic atom. Accounting for nucleus nonaxiality effects in heavy muonic atoms effects sufficiently the position of muon energy levels shifting some of them by dozens of keV and changing sometimes their sequence. The calculation method applied allows one to take account of nucleus deformation parameters of a higher order than β/sub 2/ (e.g. hexadecapole deformation β/sub 4/ parameter) if necessary when calculating V(r). 10 refs.

13763 (JINR—D-14-87-799, pp 393-397) **Monopole excitation of nucleus in the bound muon decay.** Sabirov, B.M.; Abazov, V.M.; Kutuzov, S.A. and others. 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The work is aimed at theoretical and experimental investigation into the possibility of nucleus excitation under the muon decay on mesic atom K-shell. The process of mesic atom formation is briefly considered. The stage of muon presence in the mesic atom orbit is completed by mesoatomic cascade, muon decay or muon nuclear capture. Recording of electron coincidences from decay of muon with nuclear transition γ-quanta makes up the base of experiment on the search for the nucleus excitation under the bound muon decay. Muon /sup 158/Sm atom is considered in detail. The experimental data obtained allow one to ascertain the upper limit of probability of the first /sup 152/SmO/sup +/ level excitation under the bound muon decay W<5x10/sup -3/. 10 refs.; 5 figs.; 3 tabs.

13764 (JINR—D-14-87-799, pp 295-301) **Collisions between hydrogen isotopes and their muonic counterparts.** Bracci, L.; Chiccoli, C.; Pasini, P.; Wozniak, J.; Fiorentini, G.; Meleznik, V.S. (Pisa Univ. (Italy). Ist. di Fisica; Istituto Nazionale di Fisica Nucleare, Bologna (Italy); Istituto Nazionale di Fisica Nucleare, Pisa (Italy); Cagliari Univ. (Italy). Ist. di Fisica; Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Collision between hydrogen isotopes (p, d, t) and their muonic counterparts are studied in the approach of a three-body problem and muon-catalyzed fusion. Elastic scattering and muon transfer are studied in (dμ)-t and (tμ)-d collisions. The threshold for transfer to the lighter isotope is E/sub th/=48.07 eV. The values of angular momentum taken into account are J=0,1,2. Above threshold, the computer program yields the cross section σ/sub 12/ for muon transfer from tritium to deuterium, and the cross sections, at collision energies E - E/sub th/ σ/sub 21/ and σ/sub 22/ for muonium transfer from deuterium to tritium and for elastic (dμ)+t -> (dμ)+t scattering, respectively. 9 refs.; 4 figs.

13765 (JINR—D-14-87-799, pp 389-392) **On the existence of a magnetic octupole moment in mesic atoms in 1S/sub 1/2/ and 2P/sub 1/2/ states.** Baryshevskij, V.G.; Kuten', S.A.; Rapoport, V.I. (Belorusskij Gosudarstvennyj Univ., Minsk). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

It is shown that mesic atoms, their nucleus spin J≧1, still possess octupole magnetic moment ω even in S/sub 1/2/ and P/sub 172/ states. The effect of ωnot =0 existence in S/sub 1/2/, P/sub 1/2/ states is conditioned by the same reasons which cause the existence of electrical quadrupole moment in mesic atoms with Jnot =0 in the same states: hyperfine interaction between the nucleus and negative μ-muon adds D/sub 3/2/, D/sub 5/2/... states to S/sub 1/2/ term and P/sub 3/2/, F/sub 5/2/ etc. states allowed by the law of conservation of complete moment of F mesic atom and its projection M and possessing the same parity as the initial state-to P/sub 172/ term. 4 refs.; 1 tab.

13766 (JINR—D-14-87-799, pp 398-407) **Slowing-down and Coulomb capture of negative muons in the mixture of hydrogen and helium isotopes.** Korenman, G.Ya. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

An approach is developed based on quantum equations of inlet channel (M/sup -/+A) and three-particle channel (M/sup -/+A/sup +/+e) coupling where M/sup -/-are muons and hadrons and A-atoms. The approach proposes the cross sections of M/sup -/ inelastic interactions with H and He atoms. A model of M/sup -/ inelastic interactions with hydrogen molecules is formulated on its base for the first time. Calculations of slowing down and muon Coulomb capture kinetics in hydrogen and helium isotope mixtures are performed. 17 refs.; 3 figs.

13767 (JINR—D-14-87-799, pp 408-412) **Model of negative muon inelastic interaction with hydrogen molecules.** Korenman, G.Ya.; Popov, V.P. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

A microscopic model of ionization and Coulomb capture inelastic process in collisions of slow particles M/sup -/(μ/sup -/, π/sup -/ etc.) with hydrogen molecules is developed for the first time. Muon slowing-down time (t/sub s/) is calculated from the initial energy E/sub 0/=2 keV up to the final energy for the hydrogen at 0.25 Torr pressure. The obtained value of t/sub s/=780 ns is in a satisfactory agreement with experimental (670 ns) one obtained by other authors under the same conditions. 4 refs.; 4 figs.

13768 (JINR—D-14-87-799, pp 413-417) **Slowing-down and atomic capture of negative heavy particles in helium.** Dolinov, V.K.; Korenman, G.Ya.; Moskalenko, I.V.; Popov, V.P. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

A problem concerning inelastic collisions of slow heavy negative M/sup -/ particles with helium atoms is considered on the base of the method of coupling of channels among which an inlet two-particle channel (M/sup -/+He) and three-particle channel continuum (M/sup -/+He/sup +/(1S)+e/sup -/) are considered. Results of calculating the cross section of μ/sup -/, π/sup -/, k/sup -/, p-bar and Σ/sup -/ capture by /sup 4/He atoms depending on the energy are given and the value characterizing the effective stopping is presented. 5 refs.; 3 figs.

13769 (JINR—D-14-87-799, pp 418-421) **Kinetics of slowing-down and Coulomb capture of muons in hydrogen and helium isotope mixture.** Korenman, G.Ya.; Leonova, S.V.; Popov, V.P. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Kinetics of slowing-down (S) and capture of negative muons in substance (W/sub k//sup r/) is investigated. Equation with cross sections taken from other works was solved using Monte Carlo method for D/sub 2/+DT+T/sub 2/+/sup 3/He+/sup 4/He mixture. The results show that W/sub k//sup r/ and S(He/μ) values are weakly dependent on concentration. Isotopic effect under the muon capture by D/sub 2/, DT and T/sub 2/ molecules also appears to be very low and does not exceed the limits of stochastic errors.

13770 **(LA—11436-M-Vol.4) Theoretical Atomic Physics code development IV: LINES, A code for computing atomic line spectra.** Abdallah, J. Jr.; Clark, R.E.H. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 37p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005978/JAW.

A new computer program, LINES, has been developed for simulating atomic line emission and absorption spectra using the accurate fine structure energy levels and transition strengths calculated by the (CATS) Cowan Atomic Structure code. Population distributions for the ion stages are obtained in LINES by using the Local Thermodynamic Equilibrium (LTE) model. LINES is also useful for displaying the pertinent atomic data generated by CATS. This report describes the use of LINES. Both CATS and LINES are part of the Theoretical Atomic PhysicS (TAPS) code development effort at Los Alamos. 11 refs., 9 figs., 1 tab.

13771 **(PB—89-132302/XAB) Center for Atomic, Molecular, and Optical Physics technical activities, 1988.** Gebbie, K. (National Inst. of Standards and Technology (NML), Gaithersburg, MD (USA). Center for Atomic, Molecular and Optical Physics). Dec 1988. 516p. (NISTIR—88/3881). NTIS, PC A22/MF A01.

The report summarizes the research and technical activities of the Center for Atomic, Molecular and Optical Physics during the Fiscal Year 1988. These activities include work in the areas of fundamental constants, radiation physics, surface science, plasma spectroscopy, time and frequency, quantum metrology, and quantum physics.

13772 **(RAL—88-064) Parity violation correlations in light muonic atoms.** Bernabeu, J.; Bordes, J.; Vidal, J. (Valencia Univ. (Spain). Dept. de Fisica Teorica; Rutherford Appleton Lab., Chilton (UK); Michigan Univ., Ann Arbor (USA). Randall Lab. of Physics). (Rutherford Appleton Lab., Chilton (UK)). Aug 1988. 18p. (FTUV—88/11). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755553/JAW.

The 2S-1S transition in light muonic atoms is very sensitive to parity violation correlations induced via neutral currents. Observables depending on these transitions such as the photon polarization and the angular correlation between the emitted radiation and the atom polarization are a clear signal of weak neutral currents in atoms. We find the relation between the lepton and quark couplings and these observables emphasizing the effect of the nuclear spin. The results expected in muonic atoms μ-/sup 4/He and μ-/sup 3/He are given.

13773 **(UCRL—97891) Measurements of atomic oscillator strengths using pulsed single-frequency dye lasers.** Haynam, C.; Comaskey, B.; Johnson, M.; Paisner, J.; Worden, E. (Lawrence Livermore National Lab., CA (USA)). Jan 1988. Contract W-7405-ENG-48. 22p. (CONF-880110—34). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005655/JAW.

From SPIE O-E Lase '88: optoelectronics and laser applications in science and engineering; Los Angeles, CA, USA (10 Jan 1988).

We have used two methods to measure the oscillator strength of the transition between the ground and 17992 cm/sup {minus}1/ level in ^{174}Yb. The first technique involves exciting the transition with a laser pulse that is nearly time-bandwidth limited, of uniform intensity, and has a reproducible shape from shot to shot. The population left in the excited state after the pulse varies sinusoidally with a period that depends on the integral over time of the electric field amplitude and the transition oscillator strength. These are the Rabi oscillations that are predicted by application of the Schrodinger equation to the two-level atom. The excited-state population is probed using a two-step photoionization to the continuum. The electric field amplitude is determined from the temporal profile and the intensity of the laser pulse. The second method involves observation of the polarization rotation of a set of degenerate sublevels brought about by a time-bandwidth limited light-shift laser. One sublevel (m/sub j/ = 0) of the J = 1 level at 17992 cm/sup {minus}1/ is populated by a linearly polarized laser. A second copropagating light-shift laser, which is linearly polarized at an angle to the first laser, is tuned between 7.5 and 30 GHz off-resonance with the transition. The light-shift laser causes population to be promoted into the m/sub j/ = +-1 levels by a virtual transition through the ground J = O, m/sub j/ = O level. Two linearly polarized photoionizing lasers photoionize the population only from the m/sub j/ = +-1 levels. The photoion signal oscillates sinusoidally with a period that depends only on the integrated pulse intensity, the laser detuning, and the transition oscillator strength. 5 refs., 15 figs.

6404 Fluid Physics

13774 **(AD-A—199825/1/XAB) Advanced electric propulsion MPD (magnetoplasmadynamic). Final report, 1 June 1985-31 March 1987.** Jahn, R.G.; Kelly, A.J.; Polk, J. (Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering). May 1988. 39p. (MAE—1791). NTIS, PC A03/MF A01.

Magnetoplasmadynamic (MPD) thrusters are inherently low-thrust devices, consequently operation for hundreds to thousands of hours will be required to impart useful levels of total impulse. Experience at Princeton and in other laboratories indicates that the cathode of these devices suffers the most-severe damage in the hostile environment of the high-current discharge, therefore representing the life-limiting component. To explore the physical mechanisms responsible for cathode degradation, a new diagnostic tool was developed - the surface-layer activation (SLA) technique - to monitor erosive loss. This method was chosen in the Phase I portion of this contract from several alternatives because it provides highly accurate, in-situ measurements of erosive mass loss and can be readily applied to a wide variety of materials and environments. Concurrent programs of erosion measurement on experimental MPD thrusters using this technique and supporting analytical modeling of the erosion process are now being pursued.

13775 **(AD-A—199994/5/XAB) Theoretical studies of kinetic mechanisms of negative-ion formation in plasmas. Final report, 1 June 1985-31 May 1988.** Michels, H.H. (United Technologies Research Center, East Hartford, CT (USA)). Jun 1988. 54p. (UTRC/R—88-927258). NTIS, PC A04/MF A01.

This technical program constitutes a theoretical research investigation of the kinetic mechanisms of negative ion formation in plasmas. This study was directed toward elucidating the mechanisms of the most-important volume-dependent reactions that occur in hydrogen-ion, H-(D-) source devices, primarily of the Belchenko-Dimov-Dudnikov (BDD) type and toward evaluating other light negative anions, such as Li-, as possible sources. A primary goal of this research program was to identify the most-important reactions leading to negative-ion production or destruction and to estimate these reaction cross sections and product branching ratios. A further goal was to explore new chemical sources for the production of light-mass negative atomic ions. The results of this program furnish data and provide direction for more-detailed investigations into the kinetics of both gas-phase and gas-surface reaction rates of importance in ion source devices and provide input for reliable modeling of such systems. This investigation was carried out using quantum mechanical methods. Both ab initio and density functional approaches were employed in these studies.

13776 **(AD-A—200243/4/XAB) Development of finite local perturbations of electrical conductivity in the flow of a weakly-conducting gas when a magnetic field is present.** Zaklyaz'minskiy, L.; Sokolov, V.; Degtyarev, L.; Kurdyusov, S.; Samarskiy, A. (Air Force Systems Command, Wright-Patterson AFB, OH (USA). Foreign Technology Div.). 8 Aug 1988. 7p. (FTD-ID(RS)T—0526-88). NTIS, PC A02/MF A01.

Edited trans. of Novosibirsk Aerofiz Issledovaniya (USSR) p71(1972), by Charles T. Ostertag, Jr.

A study has been made of the possibility of development of a T-layer from local finite perturbation of electrical conductivity, introduced artificially into a steady-state flow of a weakly conducting gas. The analysis is made with the help of a numerical solution of equations of magnetic hydrodynamics, formulated in the assumption that the electron, ion and neutral components of the medium are found in thermodynamic equilibrium; the viscosity, Hall effect and transfer of energy by radiation are not taken into account.

13777 **(CONF-8806234—3) Single-particle orbitals in finite systems.** Pieper, S.C. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005838/JAW.

From Conference on electron scattering from nuclei; Marciana Marina, Italy (7 Jun 1988).

Realistic ground-state wave functions for drops containing on the order of 100 atoms of ^{3}He or ^{4}He have been used to study some single-particle properties of correlated many-body systems. The quaisparticle and natural orbitals and momentum distributions are discussed. 15 refs., 8 figs.

13778 **(DOE/ER/45082—4) Neutron studies of liquid and solid helium: Progress report, May 1, 1988--April 30, 1989.** Glyde, H.R. (Delaware Univ., Newark (USA). Dept. of Physics and Astronomy). 1989. Contract FG02-84ER45082. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006115/JAW.

Liquid and solid helium are the prototype Fermi and Bose fluids and solids in nature. Understanding gained in these fundamental materials can be readily applied to more complicated materials of practical value. Neutron scattering studies at DOE supported National facilities and neutron sources abroad provide arguably the most incisive information on these fascinating materials. An improved microscopic model of Fermi liquids has been developed. The aim is to evaluate S(Q,ω) more precisely in liquid ^{3}He at intermediate Q (3 {approx←lt} Q {approx←lt} 15 {angstrom}/sup {minus}1/) for comparison with data taken at Oak Ridge and Argonne National Laboratory. The energy and lifetime of phonons in two dimensional monolayers of solid Ar on graphite have also been evaluated as a function of temperature. 6 figs.

13779 (JINR—D-14-87-799, pp 149-150) **Muon relaxation change at nitrogen melting.** Barsov, S.G.; Getalov, A.L.; Kuz'min, L.A.; Koptev, V.P.; Mikirtych'yants, S.M.; Shcherbakov, G.V.; Eshchenko, D.G.; Krasnoperov, E.P.; Storchak, V.G. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Parameters of muon spin precession in liquid nitrogen with different oxygen concentration - <or approx. 0.1%; ≃ 2% and 6% are studied in standard transverse magnetic field geometry. An assumption is made, that muon relaxation λ growth with oxygen content increase in solid nitrogen testifies to the paramagnetic state of oxygen. In liquid nitrogen containing 6% of O/sub 2/ λ reduction under melting occurs at the expense of muon and oxygen diffusion coefficient increase and therefore leads to averaging of magnetic fields on the muon. Spectrum analysis shows that in pure nitrogen as in superfluid helium a fast relaxation component with 5-100 μs/sup -1/ rate is present. Oxygen content increase up to 6% suppresses relaxation fast component. 2 refs.; 1 fig.

13780 **(LA-UR—88-4229) Experimental observations of shock stability and shock-induced turbulence.** Benjamin, R.F. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-8810234—4). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005473/JAW.

From Workshop on the physics of compressible turbulent mixing; Princeton, NJ, USA (24 Oct 1988).

We observe the Richtmyer-Meshkov (RM) instability of a perturbed, shock-accelerated interface between different gases. Instability growth of a singly shocked interface is observed to be consistent with previous experimental data. Late-time growth visually appears nonlinear but the growth rate remains the same as during linear growth. Re-shocking the interface produces additional RM growth and substantial profile broadening, which does not show the effect of local vorticity generation. 10 refs., 2 figs.

13781 **Reynolds number and end-wall effects on a lid-driven cavity flow.** Prasad, A.K.; Koseff, J.R. (Environmental Fluid Mechanics Laboratory, Department of Civil Engineering, Stanford University, Stanford, California 94305). *Physics of Fluids A: Fluid Dynamics;* **1**: No. 2, 208-218(Feb 1989).

A series of experiments has been conducted in a lid-driven cavity of square cross section (depth = width = 150 mm) for Reynolds numbers (Re, based on lid speed and cavity width) between 3200 and 10 000, and spanwise aspect ratios (SAR) between 0.25:1 and 1:1. Flow visualization using polystyrene beads and two-dimensional laser-Doppler anemometer (LDA) measurements have shed new light on the momentum transfer processes within the cavity. This paper focuses on the variation, with Re and SAR, of the mean and the rms velocities profiles, as well as the {similar←to}(U'V') profile, along the horizontal and vertical centerlines in the symmetry plane. In addition, the contribution of the large-scale "organized structures," and the high-frequency "turbulent" velocity fluctuations to the total rms is examined. At low Re, the organized structures account for most of the energy contained in the flow irrespective of SAR. As the Re increases, however, so does the energy content of the higher frequency fluctuations. This trend is not independent of SAR; a reduction in the SAR causes the "organized structures" to again become more evident.

13782 **New bounds on the permeability of a random array of spheres.** Beasley, J.D.; Torquato, S. (Department of Chemical Engineering, North Carolina State University, Raleigh, North Carolina 27695-7905). *Physics of Fluids A: Fluid Dynamics;* **1**: No. 2, 199-207(Feb 1989).

The recently derived variational principle of Rubinstein and Torquato (submitted to J. Fluid Mech.) is applied to obtain new rigorous two- and three-point upper bounds on the fluid permeability k for slow viscous flow around a random array of identical spheres which may penetrate one another in varying degrees. The n-point bounds involve up to n-point correlation function information. Both bounds are simplified and computed for the special case of mutually impenetrable spheres for a wide range of sphere volume fractions. The three-point bound is sharp and provides significant improvement over the two-point bound, especially at high sphere volume fractions (low porosities). It is the sharpest upper bound on k for a random array of impenetrable spheres developed to date and begins to approach the Kozeny--Carman empirical relation at low porosities.

13783 **Two-particle description of turbulence, Markov property, and intermittency.** Novikov, E.A. (Institute for Nonlinear Science, R-002, University of California, San Diego, La Jolla, California 92093). *Physics of Fluids A: Fluid Dynamics;* **1**: No. 2, 326-330(Feb 1989).

It is shown that the hypothesis of independent increments for velocity, which is widely used by many authors [e.g., A. M. Obukhov, Adv. Geophys. 6, 113 (1959)] in the Lagrangian description of turbulence, is inconsistent with the Navier--Stokes equations in a fundamental way. A more general Lagrangian description of turbulent velocity such as the Markov process with dependent increments, which recognizes the condition of incompressibility and the important phenomenon of intermittency, is proposed. A model of intermittent relative motion of fluid particles in turbulent flow is presented. The high-order Lagrangian moments and the probability distribution are obtained. The distribution for the intermittent vorticity is also proposed.

13784 **Hypersonic expansion of the Fokker--Planck equation.** Fernandez-Feria, R. (Department of Mechanical Engineering, Yale University, New Haven, Connecticut 06520). *Physics of Fluids A: Fluid Dynamics;* **1**: No. 2, 394-402(Feb 1989).

A systematic study of the hypersonic limit of a heavy species diluted in a much lighter gas is made via the Fokker--Planck equation governing its velocity distribution function. In particular, two different hypersonic expansions of the Fokker--Planck equation are considered, differing from each other in the momentum equation of the heavy gas used as the basis of the expansion: in the first of them, the pressure tensor is neglected in that equation while, in the second expansion, the pressure tensor term is retained. The expansions are valid when the light gas Mach number is O(1) or larger and the difference between the mean velocities of light and heavy components is small compared to the light gas thermal speed. They can be applied away from regions where the spatial gradient of the distribution function is very large, but it is not restricted with respect to the temporal derivative of the distribution function. The hydrodynamic equations corresponding to the lowest order of both expansions constitute two different hypersonic closures of the moment equations. For the subsequent orders in the expansions, closed sets of moment equations (hydrodynamic equations) are given. Special emphasis is made on the order of magnitude of the errors of the lowest-order hydrodynamic quantities. It is shown that if the heat flux vanishes initially, these errors are smaller than one might have expected from the ordinary scaling of the hypersonic closure. Also it is found that the normal solution of both expansions is a Gaussian distribution at the lowest order.

13785 **Direct-contact condensation on liquid droplets during rapid depressurization part 1.** Pasamehmetoglu, K.O.; Nelson, R.A. New York, NY; American Society of Mechanical Engineers (1987). 8p. (CONF-871234—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From ASME winter meeting; Boston, MA, USA (13 Dec 1987).

Technical Paper 87-WA/HT-7.

In this paper, direct-contact condensation on liquid droplets during a rapid depressurization, which yields a sudden decrease in the saturation temperature, is investigated. The decrease in the saturation temperature may stem either from direct-contact condensation, which is referred to as condensation-induced depressurization, or from an accidental leakage from the system, which is referred to as system depressurization. The governing equations of the direct-contact condensation on liquid droplets injected into a steam chamber are obtained based upon some simplifying assumptions. Because of the induced nature of the depressurization, the condensation rates and the depressurization rates form a coupled set of equations that must be solved simultaneously. A forward-marching finite-difference scheme is used to obtain the simultaneous solution. Only sample results for the quasi-steady solution are reported within this paper. The limitations and the errors associated with such a solution are also discussed.

6450 High Energy Physics

13786 **(DOE/ER/40419—1) Hadronic interactions at intermediate energies: Progress report, February 1, 1988--January 31, 1989.** Mayes, B.W.; Hungerford, E.V. (Houston Univ., TX (USA). Dept. of Physics). Nov 1988. Contract FG05-88ER40419. 51p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006112/JAW.

There are two major thrusts of the program: strange particle physics, where a strange quark is embedded in the nuclear medium; and lepton number violating muon decay, which involves a search for a violation of the standard model of the electro-weak interaction. Secondarily, we have a continuing interest in the elementary inelastic nucleon-nucleon interaction and in anti-nucleon physics. This latter interest results in a small but significant effort at TRIUMF. During this grant period, approximately 80% of our effort has been expended on the MEGA experiment at Los Alamos, a search for the lepton number violating decay, $\mu \rightarrow e\gamma$. Approximately 10% of our effort has been devoted to strange particle physics at Brookhaven and CEBAF, and the remaining 10% on the other programs mentioned above. These programs are briefly discussed. 17 refs., 5 figs.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 13379, 13447, 13835

13787 **(ANL-HEP-CP—88-30) A measurement of intermediate vector boson production in 1.8 TeV {bar p}p collisions.** St.Denis, R.D. (Argonne National Lab., IL (USA). High Energy Physics Div.). 27 Jun 1988. Contract W-31109-ENG-38. 7p. (CONF-8803109—10). NTIS, PC A02 - OSTI. Order Number DE89005840/JAW.

From 23. Rencontre de Moriond conference: electroweak interactions and unified theories; Les Arcs, France (6 Mar 1988).

The cross section for the production and subsequent decay to electron and neutrino of the W intermediate vector boson has been measured in 1.8 TeV {bar p}p collisions at the Collider Detector at Fermilab. An analysis of events with missing transverse energy greater than 25 GeV and an electron of transverse energy greater than 15 GeV from a data sample of 25nb/sup {minus}1/ gives σ\{center←dot\}B = 2.57 +- 0.56 +- 0.46nb, in agreement with theoretical predictions. 10 refs., 4 figs.

13788 **(ANL-HEP-CP—88-60) Charm production in e^+e^- annihilation.** Derrick, M. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 7p. (CONF-880867—18). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005809/JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

The cross sections for charm production in continuum e^+e^- annihilation near 10 GeV and near 30 GeV are presented. With the latest values for the D-mesons decay branching ratios, about 70% of the charm quarks end up in the D^0 or D/sup +-/ mesons. There is no evidence for a charm deficit. The relative production of the vector and pseudoscalar mesons is in accord with the expectations of spin counting. Measurements of the D^* decay angular distribution show that the vector mesons are primarily produced with equal populations in all helicity states, although there is some evidence for D^* alignment for the highest D^* momenta in the 10 GeV data. 13 refs., 4 figs., 1 tab.

13789 **(ANL/HEP-CP—88-63) A possible early experimental test for a large $\Delta G(x,Q^2)$.** Sivers, D.; Ramsey, G. (Argonne National Lab., IL (USA). High Energy Physics Div.). 6 Oct 1988. Contract W-31109-ENG-38. 4p. (CONF-880983—28). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005807/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

A proposal that the net spin carried by gluons in a polarized proton may be very large compared to 1/2 has recently received considerable theoretical attention. There exists a unique opportunity to test for this dramatic possibility using an existing experimental setup. We urge the consideration of a precision measurement (+-10μb) of $\Delta\sigma$/sub L//sup jet/(pp; p_0,$\sqrt{s}$) at p_0^2 = 5 GeV^2 and s = 400 GeV^2 using the Fermilab polarized beam facility. 10 refs.

13790 **(ANL-HEP-CP—88-68) Phenomenology of heavy flavor production.** Berger, E.L. (Argonne National Lab., IL (USA). High Energy Physics Div.). 13 Oct 1988. Contract W-31109-ENG-38. 14p. (CONF-880867—17). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005784/JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

A review is presented of heavy quark in {bar p}p, π^-p, and pp interactions at fixed target and collider energies. Calculations of total cross sections are described, including contributions through next-to-leading order in QCD perturbation theory. Comparisons with available data on charm and bottom quark production show good agreement for reasonable values of charm and bottom quark masses and other parameters. Open issues in the interpretation of results are summarized. A discussion is presented of signatures, backgrounds, and expected event rates for top quark production. 19 refs., 4 figs.

13791 **(BNL—41943) Limits on light Higgs bosons.** Dawson, S. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 10p. (CONF-8808145—21). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005665/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

Experimental limits on light Higgs bosons (M/sub H/ < 5 GeV) are examined. Particular attention is paid to the process K → πH. It is shown that there may be an allowed window for light Higgs bosons between about 100 and 210 MeV. 13 refs., 2 figs.

13792 **(BNL—41948) Search for flavor changing neutral currents K/sub L/^{0} → μ/sup +-/e/sup {minus←plus}/, e^+e^- and $\pi^0e^+e^-$.** Morse, W.M.; Jastrzembski, E.; Larsen, R.C.; Leipuner, L.B.; Greenlee, H.B.; Kasha, H.; Mannelli, E.B.; Mannelli, M.; Ohl, K.E.; Schaffner, S.F. (Brookhaven National Lab., Upton, NY (USA); Yale Univ., New Haven, CT (USA). Dept. of Physics). 1988. Contract AC02-76CH00016;AC02-76ER03075. 22p. (CONF-880747—4). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005663/JAW.

From 16. annual SLAC summer institute on particles physics; Stanford, CA, USA (18 Jul 1988).

We report on a search for the flavor-changing neutral-current decays K/sub L/^{0} → $\pi^0e^+e^-$, K/sub L/^{0} → e^+e^- and K/sub L/^{0} → μ/sup +-/e/sup {minus←plus}/. Limits obtained for these processes are BR(K/sub L/^{0} → $\pi^0e^+e^-$) < 3.2 x 10^{-7}, BR(K/sub L/^{0} → e^+e^-) < 1.2 x 10^{-9}, BR(K/sub L/^{0} → μ/sup +-/e/sup {minus←plus}/) < 1.9 x 10^{-9}. 10 refs., 8 figs.

13793 **(BNL—42115) Peaks in the valley: Searching for resonances in large angle exclusive scattering.** Carroll, A.S. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 7p. (CONF-880862—8). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005647/JAW.

From BNL workshop on glueballs, hybrids and exotic hadrons; Upton, NY, USA (29 Aug 1988).

The problem we pose for this talk is how to find high mass, relatively broad width, low spin resonances in the midst of very large diffractive backgrounds in hadronic interactions. One possible answer is to study large angle exclusive scattering where the forward diffraction has gone away and the background is small. Moreover, this background may be at least partially understood in the context of perturbative Quantum Chromodynamics. In this talk, we describe results from AGS Experiment 834. 13 refs., 6 figs.

13794 **(CEA-N—2562) Measurement of the strong running coupling constant from W and Z production (UA2 experiment).** Ruhlmann, V. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). May 1988. 232p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88754942/JAW.

In first approximation, W and Z production at the CERN pantip collider is described by Drell-Yan mechanism. Strong interaction accounts for corrections to this mechanism which experimentally translate into hadronic jets emitted with the produced boson, therefore acquiring a non-zero transverse momentum. Thus, studying W and Z bosons produced in association with jets allows a determination of the strong running coupling constant, α/sub s/. Two methods are a priori possible. The first one studies the boson transverse momentum distribution and the second one investigates the number of jets produced with either boson. For the Z statistics is too low to obtain an interesting result by either method. For the W the first method cannot be applied because the boson transverse momentum is not reliably measured. On the other hand, the second method leads in that case to a determination of α/sub s/.

13795 **(CONF-8810264—2) Transverse Energy in nucleus-nucleus collisions: A review.** Tincknell, M. (Oak Ridge National Lab., TN (USA)). 15 Nov 1988. Contract AC05-84OR21400. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005131/JAW.

From Conference on hadronic matter in collision; Tucson, AZ, USA (6 Oct 1988).

The status of Transverse Energy (E/sub T/) in relativistic nucleus-nucleus collisions at the Brookhaven AGS and the CERN SPS is reviewed. The definition of E/sub T/ and its physical significance are discussed. The basic techniques and limitations of the experimental measurements are presented. The acceptances of the major experiments to be discussed are shown, along with remarks about their idiosyncrasies. The data demonstrate that the nuclear geometry of colliding spheres primarily determines the shapes of the observed spectra. Careful account of the acceptances is crucial to comparing and interpreting results. It is concluded that nuclear stopping power is high, and that the amount of energy deposited

into the interaction volume is increasing with beam energy even at SPS energies. The energy densities believed to be obtained at the SPS are close to the critical values predicted for the onset of a quark-gluon plasma. 25 refs., 8 figs.

13796 **(DOE/ER/10587—7) Work to measure the decay parameters in polarized Σp → ne{bar {nu}} and CP violating parameters in K/sup O/ decay with high precision: Progress report, May 1988--May 1989.** Winston, R. (Chicago Univ., IL (USA). Enrico Fermi Inst.). 1989. Contract AC02-80ER10587. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005792/JAW.

This paper briefly discusses the following topics: polarized Σ^- β decay; analysis of ϵ'/ϵ; rare decay of K/sub L/$^0 \rightarrow \pi^0\gamma\gamma$; and the decay of K/sub L,S/ $\rightarrow \pi^0 e^+ e^-$. (LSP)

13797 **(DOE/ER/40012—8) Search for magnetic monopoles, neutrino oscillations, and high energy particles: Progress report, 1 February 1988--31 January 1989.** Lande, K. (Pennsylvania Univ., Philadelphia (USA)). Jan 1989. Contract AC02-81ER40012. 61p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005960/JAW.

We have used the Homestake Surface Air Shower Array and deep Underground Scintillation Hodoscope to measure the composition of cosmic ray primaries above 100 TeV, measure the transverse momentum of hadron interaction secondaries produced by hadrons with energies of 10^{14}eV to 10^{17}eV, put limits on the flux of magnetic monopoles, fractionally charged particles, and muon producing neutral, low mass particles that reach the earth from various active stellar systems. We propose the use of the three existing air shower arrays in the western United States as a long base line multi-array system to search for sporadic bursts of "gamma ray" like emissions from Her X-1 and other binaries that contain a neutron star. Several observations in the past year suggest that either these high energy gamma rays undergo strong interactions in the atmosphere or that there are particle with gamma ray like properties that interact as hadrons. 10 refs., 28 figs., 1 tab.

13798 **(DOE/ER/40333—T1) Hadronic atoms and leptonic conservations: Technical progress report, 1988.** Kunselman, R. (Wyoming Univ., Laramie (USA)). 1989. Contract FG02-87ER40333. 6p. (COO—2197-114). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005816/JAW.

The 1988 effort has been mainly on the leptonic conservations experiment at TRIUMF involving a search for a lepton flavor-violating reaction. The LAMPF experiment on lepton conservations has consumed our effort only in fabricating equipment. The efforts on hadronic atoms (atoms formed with pions, kaons, and sigma-minus particles) have been on the completion of analyses from the experiments at TRIUMF, LAMPF, and BNL.

13799 **(DOE/ER/40454—1) Partial-wave analyses of hadron scattering below 2 GeV: Progress report, May 1988--April 30, 1989.** Arndt, R.A.; Roper, L.D. (Virginia Polytechnic Inst., Blacksburg (USA). Dept. of Physics). [1989]. Contract FG05-88ER40454. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005748/JAW.

The Center for Analysis of Particle Scattering (CAPS) in the Department of Physics at Virginia Polytechnic Institute and State University has concentrated on analyses of basic two-body hadron reactions below 2 GeV for the last two decades. Reactions studied were nucleon-nucleon, pion-nucleon and K^+-nucleon systems. This past year the pion photoproduction reaction was added to the list. In addition to analyses of these systems, a computer graphics system (SAID) has been developed and disseminated to about 200 research institutions using VAX computers.

13800 **(INFN-LNF—87-101(P)) Physics at future colliders.** Greco, M. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1987. 13p. (CONF-8705291—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705263/JAW.

From 4. INFN ELOISATRON project workshop: very high energy proton-proton physics; Erice, Italy (31 May 1987).

The physics potential of next generation colliders are briefly reviewed, with emphasis on the CERN Large Hadron Collider (LHC) and e/sup +/e/sup -/ Linear Collider (CLIC). Results are based on realistic calculations from several studies, especially the 1987 La Thuile-CERN Workshop on Physic at Future Accelerators. 22 refs.

13801 **(INIS-mf—11887) Production and muonic decay of the intermediate vector boson Z/sup 0/ in the UA1-experiment.** Leuchs, R. (Kiel Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 17 Feb 1988. 157p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756503/JAW.

In this thesis the production of the z/sup 0/ in proton-antiproton collisions and the subsequent decay of the Z/sup -/0 into two muons is experimentally studied. I was first responsible for the faultless readout of the muon detector. In the analysis I have first selected the Z/sup 0/ data of the runs of 1984 and 1985, as well as determined the efficiency of this selection. Furthermore I have collaborated in the establishment of the p/sub t/ μ > 15 GeV/c selection. In the following the Z/sup 0/ sample was examined on completeness and the background calculated again. At c.m. energies of $\sqrt{S}$ = 546 GeV and $\sqrt{S}$ = 630 GeV in the whole 21 Z/sup 0/ events were identified by their muonic decay. The analysis of the data yielded the following essential results: M/sub Z/ = 90.7/sub -4.8//sup +5.2/ (stat.)+-3.2(syst.) GeV/c/sup 2/. From the asymmetry of the muon angular distribution we calculate the electroweak mixing angle to sin 2θ/sub W/ = 0.24/sub -0.04//sup +0.05/. The mixing can be better determined from the ratio of the W/sup +-/ and Z/sup 0/ masses. In the muon channel we obtain sin/sup 2/θ/sub W/ = 0.187+-0.148(stat.)+-0.033(syst.). If the weak mixing angle is given from the mass ratio the rho parameter can be calculated. In the muon channel we obtain rho = 1.05+-0.16(stat.)+-0.05(syst.). The measured cross sections of (σ.B)/sup μ//sub 546/ /sub GeV/ = 98.4+-49.8(stat.)+-19.9(syst) and (σ.B)/sup μ//sub 630/ /sub Gev/ = 65.9+-17.2(stat.)+-10.9(syst) are compatible with the prediction of the Drell-Yan production mechanism. From the ratio of the cross sections the number of the light neutrino generations N/sub ν/ can be limited to above. With 90% confidence N/sub ν/ < 5.7 results. The longitudinal momentum distribution of the vector bosons reflects the structure functions of the annihilating partons. Beyond the known Z/sup 0/ further heavy vector bosons below a mass of 173 GeV/c/sup 2/ are excluded. (orig./HSI).

13802 **(IPNO-DRE—87-31) Search for strange sixquark states in pp -> K/sup +/X missing mass spectra.** Frascaria, R.; Siebert, R.; Didelez, J.P. and others. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Oct 1987. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756680/JAW.

The SATURNE synchrotron was used in a pp-> K/sup +/ X experiment with high resolution to study λp and σN final interactions in a large range of momentum transfer and missing mass. Results at an incident proton energy of 2.3 GeV in the mass region for X: 2055 <M/sub X/< 2180 GeV and for kaon emission angles of 8 and 10 deg are presented.

13803 **(IPNO-DRE—87-32) Search for narrow dibaryon resonances in the ppπ/sup 0/ channel.** Blanpied, G.S.; Didelez, J.P.; Reposeur, T. and others. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Oct 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756681/JAW.

Experimental indications of dibaryon resonances (DBR) are discussed. A search for DBR using a specially built spectrometer in the elementary pion production channel: P + P->P + P + π/sup 0/ is described. A C12 target was bombarded by 800 MeV protons. The shape of the spectrum is consistent with corresponding charged π figures. Results show that the system, after modifications, can be used to hunt DBR.

13804 (JINR—D-14-87-799, pp 302-316) **Pion and muon production for fundamental research at low energies.** Bertin, A.; Bruschi, M.; Capponi, M. and others. (Bologna Univ. (Italy). Ist. di Fisica; Istituto Nazionale di Fisica Nucleare, Bologna (Italy)). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The results obtained in CERN on the low-energy pion production from a high-energy priory proton beams interaction with a long tungsten target, pion production within the deuterium-tritium fuel, production of an intermediate (decaying) pion beam, pion-muon conversion are discussed. It is shown, how these results were the experimental basis to perform systematical calculations on the cost of producing pions and muons for the purposes of muon-catalyzed fusion. 12 refs.; 5 figs.; 5 tabs.

13805 (JINR—D-14-87-799, pp 447-450) **Measurement of π/sup +/ and K/sup +/ meson lifetime by surface meson method.** Koptev, V.P.; Kruglov, S.P.; Malov, Yu.A.; Mikirtych'yants, S.M.; Shcherbakov, G.V. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

A possibility of applying surface muon beam for accurate measurement of π/sup +/- and K/sup +/-meson lifetime is shown. PI/sup +/-or K/sup +/-mesons produced in proton-nucleus interactions are stopped in the same meson-forming target. During proton microbunch duration (5 ns) π/sup +/-and K/sup +/-meson accumulation takes place, and in the intervals between microbunches (T/sub 0/=75 ns)-their decay into neutrinos and monoenergy μ-mesons. At the expence of ionization losses in the target material muons escaping from the target have momenta from 0 to 29.8 MeV/c for π->$\mu\nu$ decay (the target thickness being {similar←to}12 g/cm/sup 2/ of copper, uranium). Time distribution of the muons selected by magnetic spectrometer relatively to the reference signals linked with a certain phase of HF-accelerator generator high-frequency sinusoid and thus specifying the moments of proton transit through the target, was measured in the experiment. The results obtained are presented, comparison to measurements by other authors using other methods is made. 6 refs.; 3 figs.

13806 (LA-UR—88-4042) **Lepton-pair production in hadron-nucleus collisions.** Peng, J.C.; Alde, D.M.; Baer, H.W.; Carey, T.A.; Garvey, G.T.; Klein, A.; Lee, C.; Leitch, M.J.; Lillberg, J.W.; McGaughey, P.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 32p. (CONF-880758—8). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005452/JAW.

From Workshop on nuclear and particle physics on the light cone; Los Alamos, NM, USA (18 Jul 1988).

The general features of lepton pair production are reviewed. Physics motivations for precision measurements of lepton pair production in nuclei are discussed. Preliminary results from Fermilab experiment E772 are presented. The relevance of these results to the EMC effects and to J/{psi} suppression in heavy ion collisions is also discussed. 73 refs., 26 figs., 2 tabs.

13807 (LBL—24274) **The status of neutral currents.** Zwirner, F. (Lawrence Berkeley Lab., CA (USA)). Nov 1987. Contract AC03-76SF00098. 11p. (CONF-8708230—2). NTIS, PC A03/MF A01. Order Number DE88008243/JAW.

From NATO advanced studies institute summer school on particle physics; Cargese, France (3 Aug 1987).

The situation of particle physics today is quite puzzling. On the one hand, the Standard Model (SM) of strong and electroweak interactions is consistent with all confirmed experimental data but theoretically rather unsatisfactory. On the other hand, none of the many theoretical speculations which try to go beyond the SM has (yet) received the slightest experimental support. The solution to this dilemma can only come from new data: either from the detection of a new particle threshold at high energy colliders, or from the appearance of some small discrepancy in high-precision experiments. A crucial sector for testing the SM and its extensions is that of neutral currents (NC), where an impressive amount of data has been collected in recent years. While waiting for the next generation of experiments, it is certainly useful to take stock of our knowledge, determining the NC parameters as precisely as we can and putting limits on possible deviations from the SM. The present talk contains the results of a recent analysis along these lines: the first part illustrates how a set of 'model-independent' parameters can be extracted from the available NC data, the second part particularizes the analysis to the SM and to some superstring-inspired models with an additional Z' in their low-energy spectrum. 27 refs., 3 figs., 1 tab.

13808 (SLAC-PUB—4616) **H^0 at a 300 GeV e^+e/sup {minus}/ collider.** Grosse-Wiesmann, P. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1988. Contract AC03-76SF00515. 7p. (CONF-8801137—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006006/JAW.

From Workshop on intermediate mass and nonminimal Higgs bosons at the SSC transparencies; Davis, CA, USA (4 Jan 1988).

In the mass range from 80–180 GeV, no simple strategy for a detection of the H^0 presently exists. Here we investigate the reaction e^+e/sup {minus}/ $\rightarrow H^0Z^0$ at a center-of-mass energy of 300 GeV. We calculate the necessary luminosity to observe the H^0 in the missing mass distribution of the $Z^0 \rightarrow l + l$/sup {minus}/. Possibilities for realizing an e^+e/sup {minus}/ collider with sufficient luminosity at such energies are investigated. In particular, the possibility of colliding an electron linear accelerator with a positron storage ring is discussed. 19 refs., 2 figs., 1 tab.

13809 (SLAC-PUB—4694) **Results on semileptonic D^0 and D/sub s/ decays and evidence for non-D{bar D} decays of the {psi} (3770).** Schindler, R.H. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1988. Contract AC03-76SF00515;AC03-81ER40050;AC02-76ER01195;AC02-87ER40318. 7p. (CONF-880867—19). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006007/JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

This paper discusses the following topics: Observation of Cabibbo suppressed semileptonic D^0 decays; Search for D/sub s/ semileptonic decays; and Preliminary evidence for non-D{bar D} decays of the {psi} (3770). 4 refs., 3 figs., 2 tabs.

13810 (SLAC-PUB—4739) **Tutorial guide to the tau lepton and close-mass lepton pairs.** Perl, M.L. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 7p. (CONF-8808180—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006063/JAW.

From International school of subnuclear physics on the super world III; Erice, Italy (7 Aug 1988).

This is a tutorial guide to present knowledge of the tau lepton, to the tau decay mode puzzle, and to present searches for close-mass lepton pairs. The test is minimal; the emphasis is on figures, tables and literature references. It is based on a lecture given at the 1988 International School of Subnuclear Physics: The Super World III. 54 refs., 9 figs., 7 tabs.

13811 (SLAC-PUB—4768) **The strangeonium spectrum seen in LASS; implications for glueball spectroscopy.** Aston, D.; Awaji, N.; Bienz, T.; Bird, F.; D'Amore, J.; Dunwoodie, W.; Endorf, R.; Fujii, K.; Hayashii, H.; Iwata, S. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 6p. (CONF-880862—10). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006066/JAW.

From BNL workshop on glueballs, hybrids and exotic hadrons; Upton, NY, USA (29 Aug 1988).

The status of strangeonium spectroscopy is re-assessed following our recent high statistics study of K/sup {minus}/ induced hypercharge exchange reactions. The implications of our results for the status of glueball, or otherwise exotic, candidates observed in

the same decay modes but produced by different mechanisms are also discussed. 11 refs., 8 figs.

13812 **(SLAC-PUB—4784) Review of J/{psi} decays.** Toki, W.H. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1988. Contract AC03-76SF00515;AC03-81ER40050;AC02-76ER01195. 6p. (CONF-8808145—24). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005964/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

Recent results from the Mark III collaboration in radiative J/{psi} decays are presented. This includes a study of iota/E decays in J/{psi}→γ{eta}ππ and γγp, two pseudoscalar decays near threshold in J/{psi}→γππ and γ {bar K}K and two vector decays in J/{psi}→γ {bar K}/sup o/*K/sup o/*. 20 refs., 9 figs.

13813 **Subthreshold multiple pion production in nucleus-nucleus collisions.** Friedlander, E.M.; Navarra, F.S.; Weiner, R.M. (Physics Dept., Univ. of Marburg (DE));. *Modern Physics Letters B;* 3: No. 15, 1461-1472(Nov 1988).

With the intermediate energy heavy in accelerators which will begin operation soon, multiple subthreshold pion production will become more feasible. The authors derive within a geometrical model the distribution function of available energy for particle production of secondaries and calculate the ratio between the probability of double and single pion production in subthreshold processes. This quantity is model dependent and its measurements could thus help in discriminating between different models.

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REFER ALSO TO CITATION(S) 13716, 13790, 13799, 13806, 13807, 13810, 13838, 13852, 13853, 13883

13814 **(ANL-HEP-CP—88-67) Heavy flavor production at fixed target and collider energies.** Berger, E.L. (Argonne National Lab., IL (USA). High Energy Physics Div.). 13 Oct 1988. Contract W-31109-ENG-38. 10p. (CONF-8808145—22). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005862/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

A review is presented of heavy quark production in {bar p}p, π^-p, and pp interactions at fixed target and collider energies. Calculations of total cross sections are described including contributions through next-to-leading order in QCD perturbation theory. Comparisons with available data on charm and bottom quark production show good agreement for reasonable values of charm and bottom quark masses and other parameters. Open issues in the interpretation of results are summarized. A discussion is presented of signatures, backgrounds, and expected event rates for top quark production. 19 refs., 4 figs.

13815 **(BNL—42050) Radiative corrections to heavy Higgs physics.** Willenbrock, S. (Brookhaven National Lab., Upton, NY (USA)). Oct 1988. Contract AC02-76CH00016. 6p. (CONF-8808145—20). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005769/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

The one-loop correction to the width of a 1 TeV Higgs boson is rather modest; it increases the tree width by only 15%. This is surprising in light of the fact that the particle is strongly coupled to itself and to longitudinal gauge bosons. We argue that this may be understood in terms of an effective energy-dependent coupling which is strong for s > m/sub H/^{2} but weak for s < m/sub H/^{2}. 8 refs., 1 fig.

13816 **(CONF-8706198—3) Oxygen induced reactions at 200 and 60 GeV/nucleon.** Schmidt, H.R.; Albrecht, R.; Awes, T.C.; Baktash, C.; Beckmann, P.; Claesson, G.; Berger, F.; Bock, R.; Dragon, L.; Ferguson, R.L.; Franz, A.; Garpman, S.; Glasow, R.; Gustafsson, H.A.; Gutbrod, H.H.; Johnson, J.W.; Kampert, K.H.; Kolb, B.W.; Kristiansson, P.; Lee, I.Y.; Loehner, H.; Lund, I.; Obenshain, F.E.; Oskarsson, A.; Otterlund, I.; Peitzmann, T.; Persson, S.; Plasil, F.; Poskanzer, A.M.; Purschke, M.; Ritter, H.G.; Santo, R.; Siemiarczuk, T.; Sorensen, S.P.; Stenlund, E.; Young, G.R. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Oak Ridge National Lab., TN (USA); Muenster Univ. (Germany, F.R.); Lawrence Berkeley Lab., CA (USA); Lund Univ. (Sweden)). Oct 1987. Contract AC05-84OR21400. 15p. (GSI—87-64). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE88006975/JAW.

From 27. Cracow school of theoretical physics: structure of fundamental interactions; Zakopane, Poland (3 Jun 1987).

This paper discusses the use of ultra-relativistic heavy-ion collisions to investigate the possible existence of a transition to the quark-gluon plasma. Detectors and experimental setup are described. 15 refs., 18 figs. (LSP)

13817 **(CONF-8805142—48) Hypernuclear interactions and the binding energies of Λ and ΛΛ hypernuclei.** Bodmer, A.R.; Usmani, Q.N. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005836/JAW.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

By use of variational calculations a reasonable hadronic description is obtained of the s-shell hypernuclei, of /sub Λ/^{9}Be, and of the well depth, with ΛN forces which are consistent with Λp scattering and which are quite strongly spin-dependent, with reasonable TPE ΛNN forces with strongly repulsive dispersive-type ΛNN forces. For the latter we also consider a spin-dependent version which is somewhat favored by our analysis. /sub Λ/^{9}Be is treated as a 2α + Λ system and is significantly overbound, ≃1 MeV, if only αα and αΛ potentials are used. An ααΛ potential obtained from the ΛNN forces nicely accounts for this overbinding. The ΛΛ hypernuclei /sub ΛΛ/^{6}He and /sub ΛΛ/^{10}Be are treated as α + 2Λ and 2α + 2Λ systems. Use of the /sub ΛΛ/^{10}Be event gives ≃1.5 MeV too little binding for /sub ΛΛ/^{6}He. The $^1S_0$ ΛΛ potential obtained from /sub ΛΛ/^{10}Be is quite strongly attractive, comparable to the ΛN and also to the NN potential without OPE. 18 refs.

13818 **(DOE/ER/40150—54) Relativistic quark clustering in the $\gamma\gamma \to \pi^+\pi^-$ and $\pi^0\pi^0$ reactions.** Ito, Hiroshi; Buck, W.W.; Gross, F. (Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility). 1988. Contract AC05-84ER40150. 16p. (CEBAF-PR—88-017). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006252/JAW.

Cross sections for pion pair production by photon-photon collisions are estimated near the threshold using a relativistic quark clustering model. A realistic q{bar q} wave function of the pion was determined by fitting the pion charge form factor up to $q^2 = 4$ {approximately} 6GeV^2/c^2, the weak decay constant and the pion charge radius. The composite structure of the pion provides a simple explanation for the energy dependence and magnitudes of $\pi^+\pi^-$ and $\pi^0\pi^0$ pair productions. 18 refs., 3 figs., 1 tab.

13819 **(DOE/ER/40150—55) Polarization response functions and the ({rvec e},e'{rvec p}) reaction.** Picklesimer, A.; Van Orden, J.W. (Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility). 1988. Contract AC05-84ER40150;W-7405-ENG-36. 38p. (CEBAF-PR—88-018). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006255/JAW.

The first comprehensive study of the full set of eighteen response functions relevant to the ({rvec e},e'{rvec p}) reaction is presented. Benchmark analytical features and limiting cases of the response functions are described. Numerical predictions contrasting nonrelativistic and relativistic (Dirac) dynamics and on- and off-shell final state interaction effects are presented. Basic physical characteristics and dependences of the response functions are identified. The outlook for future experimental studies of the ({rvec e},e'{rvec p}) polarization response functions is discussed. 56 refs., 5 figs., 1 tab.

13820 **(DOE/ER/40150—57) Final state interactions and relativistic effects in the quasielastic (e,e') reaction.** Chinn, C.R.; Picklesimer, A.; Van Orden, J.W. (Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility; Los Alamos National Lab., NM (USA)). Nov 1988. Contract AC05-84ER40150;W-7405-ENG-36. 66p. (CEBAF-PR—88-020). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006253/JAW.

The longitudinal and transverse response functions for the inclusive quasielastic (e,e') reaction are analyzed in detail. A microscopic theoretical framework for the many-body reaction provides a clear conceptual (nonrelativistic) basis for treating final state interactions and goes far beyond simple wave or Hermitean potential models. The many-body physics of inelastic final state channels as described by optical and multiple scattering theories included by incorporating a full complex optical potential. Explicit nonrelativistic and relativistic momentum-space calculations quantitatively demonstrate the importance of such a treatment of final state interactions for both the transverse and longitudinal response. Nonrelativistic calculations are performed using final state interactions based on phenomenology, local density models and microscopic multiple scattering theory. Relativistic calculations span a similar range of models and employ Dirac bound state wave functions. The theoretical extension to relativistic dynamics is of course not clear, but is done in obvious parallel to elastic proton scattering. Extensive calculations are performed for ^{40}Ca at momentum transfers of 410, 550 and 700 MeV/c. A number of interesting physical effects are observed, including significant relativistic suppressions (especially for R/sub L/), large-off-shell and virtual pair effects, enhancement of the tails of the response by the final state interactions, and large qualitative and even shape distinctions between the predictions of the various models of the final state interactions. None of the models is found to be able to simultaneously predict the data for both response functions. This strongly suggests that additional physical mechanisms are of qualitative importance in inclusive quasielastic electron scattering. 48 refs., 16 figs.

13821 **(DOE/ER/40153—5-Pt.2) [Investigations in particle theory: Second part]: Progress report.** (Cincinnati Univ., OH (USA). Dept. of Physics). [1989]. Contract FG02-84ER40153. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006117/JAW.

In the past year we have worked on one of the most important unsolved problems in particle physics, i.e., understanding the mechanism of mass generation for W and Z and quarks and leptons. We have made some progress towards obtaining a solution. Our investigations were directed at constructing a phenomenologically viable mechanism of mass generation based on dynamical symmetry breaking.

13822 **(FNAL/C—88/191) Heavy quark production and QCD.** Purohit, M.V. (Fermi National Accelerator Lab., Batavia, IL (USA)). Dec 1988. Contract AC02-76CH03000. 11p. (CONF-8808145—17). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005625/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

Recent results on charm and beauty production in fixed target experiments are reviewed. Particular emphasis is placed on the recent results, on the trend favored by the data, on companies with the recently improved QCD predictions and on what may be expected in the near future. 35 refs., 5 figs.

13823 **(IC—88/171) Light and heavy quark masses, test of PCAC and flavour breakings of condensates in QCD.** Narison, S. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705338/JAW.

Results from current algebra and QCD spectral sum rules (QSSR) in different hadronic channels within tau or n (sum rule variable) and t/sub c/ (continuum threshold) stability criterions or (and) t/sub c/-values fixed from FESR are combined to give improved estimates of the light (u, d, s) and heavy (c, b) quark masses. In particular, the weighted averages of the s and b quark mass values are (unavoidably) accurate: m-bar/sub s/(1GeV)=(159.5+-8.8)MeV and M/sub b/(q/sup 2/=M/sup 2//sub b/)=(4.58+-0.05)GeV. Pion (resp. kaon) PCAC violations of (5+-0.5)%(resp.(36.5+-7.5)%) are observed while the values of the quark condensate ratios are: <d-bar d>/<u-bar u>=1.-9 10/sup -3/ and <s-bar s>/u-bar u>=(0.6+-0.1). These confirm and improve earlier QSSR estimates and provide an indirect support of the q-bar q nature of the a/sub 0/(0.98) and K*/sub 0/(1.35). Values of the "current" running masses of the c, b quarks are presented. Attempts to give the values of the light quark "perturbative constituent" masses are done. (author). 30 refs.

13824 (JINR—D-14-87-799, pp 279-294) **On the role of negative muons stopped in matter to determine the weak interaction fundamental constants.** Bertin, A.; Bruschi, M.; Capponi, M. and others. (Bologna Univ. (Italy). Ist. di Fisica; Istituto Nazionale di Fisica Nucleare, Bologna (Italy)). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The results obtained on the weak interaction fundamental constants by studying positive and negative muon processes at rest are examined. The muon decay and the muon nuclear capture by protons and deuterons are taken into consideration. The implications which can be obtained from the muon lifetime on the weak interaction Fermi coupling constant are discussed. The information derived from muon capture experiments in hydrogen and deuterium on the pseudoscalar coupling constant g/sub p//sup μ/ and on the axial vector coupling constant g/sub p//sup μ/ is also discussed. On these lines important contributions were achieved both in western laboratories (Chicago, Columbia, Bologna - Cern, Saclay - Bologna) and at JINR in Dubna. 30 refs.; 4 figs.; 5 tabs.

13825 (JINR—D-14-87-799, pp 442-446) **Application of μSR method to the search of muon rare decays.** Gordeev, V.A. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Experiment on the search for μ/sup +/->l/sup +/α decay where α is familon, can be conducted in the following way. Using standard MSR-technique supplemented at the electron telescope outlet by magnetic spectrometer with energy resolution os no worse than 5x10/sup -4/, precession MSR-spectra of polarized muons, stopped in a target of a substance with high conductivity electron density (to prevent depolarization at the expense of bound state formation) in the perpendicular magnetic field are recorded as the positron energy function and asymmetry coefficient dependence on the energy is constructed. The presence of μ/sup +/->l/sup +/α decay will lead to abrupt asymmetry coefficient reduction at the end of positron spectrum. 9 refs.; 1 tab.

13826 **(LA-UR—88-4013) Neutrino-electron scattering and the search for new physics.** Rosen, S.P. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 17p. (CONF-8809223—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005448/JAW.

From Workshop on new directions in neutrino physics; Batavia, IL, USA (14 Sep 1988).

I want to discuss the role of neutrino-electron scattering in the search for physics beyond the standard model. The standard model makes specific predictions about the nature of the neutrinos

which participate in such processes and about the interactions responsible for them. The process upon which I shall concentrate is elastic scattering, but I shall pay some attention to inelastic processes in which the target electron is itself transformed into a heavier charged lepton, in other words the inverse of the decay of the heavier lepton. In the case of elastic scattering we are mainly looking at neutral-currents and we can ask a series of simple questions: Does the interaction conserve lepton flavor? Does it fit the prescriptions of the standard model? Are the neutrinos Majorana or Dirac particles? In the case of inverse muon and tau decays we are looking at charge-currents, and we want to pin down the identity of the neutrinos emitted in the decay of these charged leptons as well as to set bounds on non-(V-A) components of the interaction. In order to discuss these topics, it is useful to review the general properties of the scattering process, especially the kinematics and the general form of the differential cross-section. Kinematics are important because they prevent us from searching for some processes and effects which we would like to detect. The differential cross-section, if measured with sufficient care, may tell us something about the presence of non-standard terms in the interaction and even about the nature of the neutrino. The detailed outline of the talk is: identity of the final state neutrino; kinematics; differential cross-sections; oscillations and universality; a test for Dirac neutrinos; inverse muon decay; and the standard model and radiative corrections. 22 ref., 2 tabs.

13827 **(RAL—88-049) Determination of the strong coupling constant αsub(s) from e/sup +/e/sup -/ total cross-section data.** Marshall, R. (Rutherford Appleton Lab., Chilton (UK)). Jun 1988. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754964/JAW.

Submitted to Zeit. Phys. C.

All the published data on quark pair final states in the continuum in e/sup +/e/sup -/ annihilation have been analysed in a self consistent way to study the behaviour of the strong coupling constant, αsub(s) and the associated scale parameter. The best fit results for αsub(s) and lαsub(s)l at s = Q/sup 2/ = 1000 GeV/sup 2/ are given. These fits provide a good description of the R continuum from Q/sup 2/ = 7 GeV/sup 2/ all the way through two distinct quark thresholds to Q/sup 2/ = 2704 GeV/sup 2/. By including terms up to 3rd order in αsub(s), it is shown that these 3rd order terms have a considerable effect and that 4th order corrections may be needed.

13828 **(RAL—88-057) Summary talk 23rd Rencontre de Moriond 13-18 March 1988.** Albrow, M.G. (Rutherford Appleton Lab., Chilton (UK)). 1988. 26p. (CONF-880399—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754967/JAW.

From 23. Rencontre de Moriond: current issues in hadron physics; Les Arcs, France (13 Mar 1988).

A personal view of some highlights of the meeting is presented. The subjects range from dark matter to colliding nuclei, small angle elastic scattering to high rhosub(tau) jets, and from π/sup 0/ formation in $\gamma\gamma$ collisions to charm, beauty and top quark production.

13829 **(RAL—88-067) Weak decays of stable particles.** Brown, R.M. (Rutherford Appleton Lab., Chilton (UK)). Sep 1988. 112p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705392/JAW.

Submitted to Reports on Progress in Physics.

In this article we review recent advances in the field of weak decays and consider their implications for quantum chromodynamics (the theory of strong interactions) and electroweak theory (the combined theory of electromagnetic and weak interactions), which together form the "Standard Model" of elementary particles.

13830 **(RAL—88-068) Hierarchy of quark masses in the isotropic doublets in N = 1 supergravity models.** Olechowski, M.; Pokorski, S. (Warsaw Univ. (Poland). Inst. Fizyki Teoretycznej). (Rutherford Appleton Lab., Chilton (UK)). Aug 1988. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755554/JAW.

In the framework of some generic softly broken SUSY models we study the SU(2)xU(1) breaking by radiative corrections, starting with the Yukawa couplings which at the Planck scale Msub(p) satisfy hsup(t)=hsup(b). Physically acceptable solutions exist with the hierarchy of vev's: v/sub 2//v/sub 1/ ≃ msub(t)/msub(b) provided msub(t) ≧ 50 GeV. When the SUSY breaking is driven only by the gaugino mass the solutions uniquely predict v/sub 2/ = O(10)v/sub 1/ and the top mass in the range (50-65) GeV. Also the mass ratio in the second quark generation can be accounted for.

13831 **(RAL—88-084) Non-commutative geometry of string field theory.** Chan Hong-Mo; Tsou Sheungtsun. (Rutherford Appleton Lab., Chilton (UK); Oxford Univ. (UK). Mathematical Inst.). (Rutherford Appleton Lab., Chilton (UK)). Oct 1988. 6p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705395/JAW.

We analyse the geometry of string field theory in exactly the same way as one would analyse the geometry of Yang-Mills theory. We find that a version of non-commutative geometry, where the differential forms are considered as infinite matrices, seems to provide a suitable context for studying string field theory.

13832 **(SLAC-PUB—4753) Semileptonic charm decay.** Izen, J.M. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1988. Contract AC03-76SF00515;AC03-81ER40050;AC02-76ER01195;AA03-76SF00034. 10p. (CONF-8808145—18). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005611/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

Semileptonic branching ratios for $D^0 \rightarrow \pi^- e^+ \nu$/sub e/, $K^- e^+ \nu$/sub e/ and $K^- \mu^+ \nu$/sub e/ are presented, leading to a measurement of V/sub cd//V/sub cs/. Seven additional exclusive D^0 and D^+ semileptonic branching ratios and a first inclusive D/sub s/$^+$ measurement are given. 6 refs., 5 figs., 1 tab.

13833 **(SLAC-PUB—4824) BNL glueball review.** Toki, W.H. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 10 Dec 1988. Contract AC03-76SF00515;AC03-81ER40050;AC02-76ER01195;AC02-87ER40318. 11p. (CONF-880862—9). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005968/JAW.

From BNL workshop on glueballs, hybrids and exotic hadrons; Upton, NY, USA (29 Aug 1988).

The glueball session of the BNL workshop on glueballs, hybrids and exotic hadrons is reviewed. This include studies of K{bar K}π, {eta}$\pi\pi$, γ{rho}{degree}, $\pi\pi$, K{bar K}, {eta}{eta}, {phi}{phi}, {rho}{rho}, $\omega\omega$, and K*{bar K}* resonances produced in $\gamma\gamma$, J/{psi}, K/sup minus/p and π/sup minus/p reactions. 44 refs., 5 figs., 4 tabs.

13834 **(SLAC-PUB—4827) B meson physics with polarized electron beams at linear colliders running at the Z^0.** Atwood, W.B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1988. Contract AC03-76SF00515. 8p. (CONF-8806243—21). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006071/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

The expected large cross section for $e^+e^- \rightarrow Z^0$ and subsequent decay to b{bar b} quarks makes the Z^0 an attractive placeto pursue B meson physics. The cross section for b-quark production at the Z^0 is compared to resonance production at the Y/sub 4s/ and Y/sub 5s/. In addition the big electroweak asymmetries, thought to exist in Z^0 decays to b{bar b} quarks with polarized electron beams, provide an outstanding handle for observation of such effects as B^0 - {bar B}^{0} mixing. In this paper, the feasibility of such measurements is investigated and, with relatively small samples of Z^0's (a few hundred thousand), both B/sub d/ and B/sub s/ meson mixing are shown to be measurable. The subject of CP violation in neutral B mesons is discussed last, but presently such measurements seem to be out of reach. 7 refs., 7 figs., 3 tabs.

13835 **(SLAC-PUB—4829) Prospects in B physics.** Gilman, F.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1988. Contract AC03-76SF00515. 27p. (CONF-8811125—3). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006072/JAW.

From Rare decay symposium; Vancouver, Canada (30 Nov 1988).

The status of B physics is reviewed with emphasis on the prospects for further developments, including the study of CP violating effects in the B mesons system. 29 refs., 13 figs.

13836 **(USIP—87-12) Corrections for the pseudorapidity gap correlation method.** Fuglesang, C. (Stockholm Univ. (Sweden). Inst. of Physics). Jun 1987. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756212/JAW.

It is shown that the method of studying particle correlations using gaps between particles in rapidity or pseudorapidity containing a fixed number of particles, is biassed. Corrections have to be done, at least when the data samples are small. It is shown how these corrections were carried out on data taken by the UA5 experiment.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 13985, 13986, 13987

13837 **(INS—701) Cohomology for covariant anomalies.** Tsutsui, Izumi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Sep 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756542/JAW.

We study a new cohomology approach to the covariant anomalies in detail. A set of differential forms is constructed from descent-like 'sidestepping' equations. From this set, we can derive the covariant anomalies including the commutator anomaly as well as the current anomaly with correct normalizations. We also discuss the relation to the conventional set of differential forms for the consistent anomalies.

13838 **Four dimensional superstring theories in orbifold-like construction.** Kikuchi, Y. (Center for Theoretical Physics, Texas A and M Univ., College Station, TX (US)); Ubriaco, M.R. (Institute of Field Physics, Dept. of Physics and Astronomy, Univ. of North Carolina, Chapel Hill, NC (US));. *Modern Physics Letters B;* **3**: No. 15, 1431-1440(Nov 1988).

The authors present a construction of string theories based on the orbifold-like boundary condition on the world sheet fields in the NSR formalism. A simple model is given. In this letter, they also consider the orbifold-like construction of four dimensional string theories in the Neveu, Schwarz and Ramond formalism. The authors' main concern is to look for models with rank lower than 8. The authors' approach is designed analogously to the fermionic way, so they give a brief description of the prescription and a simple example of rank 6, although it is not realistic.

6454 Field Theory

REFER ALSO TO CITATION(S) 13838, 13985, 13987

13839 **(BiBoS—307/88) Stability of ground states in nonlinear classical field theories.** Stubbe, J. (Bielefeld Univ. (Germany, F.R.). Fakultaet fuer Physik). (Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS); Bielefeld Univ. (Germany, F.R.). Fakultaet fuer Physik). 1988. 70p. Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS).

We develop a stability theory for abstract Hamitonian systems arising from many models in classical field theories: Their solitary wave solutions are characterized by minimization principles (ground states) and their energy functional has the so-called scale-covariance property. In addition the systems may be invariant under one-parameter groups of isometric operators. We present sharp stability and instability conditions for ground state solitary waves. Our theory applies to a large series of examples. In particular we are able to give a more general study of the stability properties of solitary waves of nonlinear Klein-Gordon equations and nonlinear Schroedinger equations.

13840 **(BONN-IR—87-13) On the Schroedinger representation of the Euclidean quantum field theory.** Semmler, U. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). Apr 1987. 86p. (In German). Bonn Univ. (Germany, F.R.). Physikalisches Inst.

The theme of the present thesis is the Schroedinger representation of the Euclidean quantum field theory: We define the time development of the quantum field states as functional integral in a novel, mathematically precise way. In the following we discuss the consequences which result from this approach to the Euclidean quantum field theory. Chapter 1 introduces the theory of abstract Wiener spaces which is here proved as suitable mathematical tool for the treatment of the physical problems. In chapter 2 the diffusion theory is formulated in the framework of abstract Wiener spaces. In chapter 3 we define the field functional psi/sup 5/u, t/ sup 7/ as functional integral, determine the functional differential equation which psi satisfies (Schroedinger equation), and summarize the consequences resulting from this. Chapter 4 is dedicated to the attempt to determine the kernel of the time-development operator, by the knowledge of which the time development of each initial state is fixed. In chapter 5 the consequences of the theory presented in chapter 3 and 4 are discussed by means of simple examples. In chapter 6 the renormalization which results for the phi 4 potential from the definition of the functional integral in chapter 3 is calculated up to the first-order perturbation theory, and it is shown that the problems in the Symanzik renormalization procedure can be removed. (orig./HSI).

13841 **(DOE/ER/04915—3) [Studies in quantum field theory]: Progress report.** Polmar, S.K. (Washington Univ., Seattle (USA)). 1988. Contract AC02-78ER04915. 6p. NTIS, PC A02/MF A01 - OSTI; GPO Dep. Order Number DE89006286/JAW.

The theoretical physics group at Washington University has been devoted to the solution of problems in theoretical and mathematical physics. All of the personnel on this task have a similar approach to their research in that they apply sophisticated analytical and numerical techniques to problems primarily in quantum field theory. Specifically, this group has worked on quantum chromodynamics, classical Yang-Mills fields, chiral symmetry breaking condensates, lattice field theory, strong-coupling approximations, perturbation theory in large order, nonlinear waves, 1/N expansions, quantum solitons, phase transitions, nuclear potentials, and early universe calculations.

13842 **(FNAL/C—88/165) A floating point engine for lattice gauge calculations.** Husby, D.; Atac, R.; Cook, A.; Deppe, J.; Fischler, M.; Gaines, I.; Nash, T.; Pham, T.; Zmuda, T.; Eichten, E. (Fermi National Accelerator Lab., Batavia, IL (USA)). Nov 1988. Contract AC02-76CH03000. 5p. (CONF-881103—24). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005619/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

The latest in low cost computing solutions from the Fermilab Advanced Computer Program is targeted at Lattice Gauge theory calculations and delivers supercomputer performance at a fraction of the cost. A typical system with 256 processors, 2.5 Gigabytes of memory, and 64 Gigabytes of on-line tape storage, delivers a peak performance of 5 billion floating point operations per second. The programming environment, Canopy, provides a comprehensive, hardware independent, distributed processing platform from within the more familiar environments of FORTRAN, C, and UNIX. This paper describes the individual processing elements of the system and gives a brief description of the Canopy software. 8 refs., 3 figs.

13843 (IC—88/180) On heterotic supermanifolds. Randjbar-Daemi, S.; Salam, A.; Strathdee, J. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 34p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705339/JAW.

The geometry of heterotic supermanifolds is discussed with particular reference to patching conditions and gauge fixing. Superfield formalism is used and the associated torsion constraints are solved explicitly in an arbitrary gauge, that is without imposing gauge conditions. Finite gauge transformations are constructed. The structure group associated with Wess-Zumino type gauges is obtained and is reduced by further refinements of the gauge conditions up to the stage at which the standard description of the super Riemann surface is recovered. It is shown that any invariant functional of the super 3-bein can depend only on a finite number of parameters, i.e. the moduli and super moduli. Chiral superfields and the structure of action functionals are discussed and, finally the integration measure in supermoduli space is derived by an application of the Faddeev-Popov prescription. (author). 15 refs.

13844 (IC—88/211) Nonexistence theorems for Yang-Mills fields outside the black hole of the Schwarzschild spacetime. Masood-Ul-Alam, A.K.M.; Pan Yanglian. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705351/JAW.

In this paper, the authors prove some nonexistence theorems for regular static Yang-Mills fields outside the black hole of the Schwarzschild spacetime under certain boundary conditions. (author). 3 refs.

13845 (IC—88/212) Pinching conditions for Yang-Mills instability of hypersurfaces. Pan Yanglian. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705352/JAW.

A compact Riemannian manifold M is said to be Yang-Mills instable, if for every choice of compact Lie group G and every principle G-bundle P over M, none of the nonflat Yang-Mills connection in P is weakly stable. This paper gives curvature pinching condition for the Yang-Mills instability of hypersurfaces in space form. (author). 3 refs.

13846 (IC—88/213) Nonexistence of stable harmonic maps from sufficiently pinched simply connected Riemannian manifolds. Pan Yanglian. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 11p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705353/JAW.

It is proved that for $n \geq 3$ there exists a constant $\delta(n)$ with $1/4 \leq \delta(n) < 1$ such that if M is a simply connected Riemannian manifold of dimension n with $\delta(n)$-pinched curvatures then for every Riemannian manifold N every stable harmonic map PHI:M->N is constant. Together with Howard's result, it shows that a simply connected sufficiently pinched Riemannian manifold is weakly E-unstable. (author). 8 refs.

13847 (IC—88/306) Correlation functions for minimal models on the torus. Jayaraman, T.; Narain, K.S. (International Centre for Theoretical Physics, Trieste (Italy); European Organization for Nuclear Research, Geneva (Switzerland)). (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 35p. (CERN-TH—5166/88). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705368/JAW.

A Coulomb gas approach to the construction of correlation functions for minimal models on the torus is presented. In particular the conformal blocks for the two point function (phi/sub 12/phi/sub 12/) are discussed in detail and their monodromy properties and modular transformations are derived. We also obtain the modular and monodromy invariant combination of the left and right blocks of the correlation function. (author). 16 refs, 10 figs.

13848 (NBI-HE—88-65) Towards a covariant super-Reggeon calculus for the superstring. Petersen, J.L. (Niels Bohr Inst., Copenhagen (Denmark)). Oct 1988. 26p. (CONF-8806302—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756525/JAW.

From Landau birthday symposium; Copenhagen, Denmark (13 Jun 1988).

In this talk I outline our technique for calculating string amplitudes in perturbation theory around flat background space-time. Our approach consists in evaluating the Polyakov path integral in the BRST-formulation with specifically chosen boundary conditions corresponding to external coherent states. (orig./HSI).

13849 (NBI-HE—88-66) Electromagnetic properties of the Higgs vacuum. Damgaard, P.H.; Heller, U.M. (Niels Bohr Inst., Copenhagen (Denmark); California Univ., Santa Barbara (USA). Inst. for Theoretical Physics). (Niels Bohr Inst., Copenhagen (Denmark); California Univ., Santa Barbara (USA). Inst. for Theoretical Physics). Oct 1988. 8p. (CONF-8808185—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756526/JAW.

From Meeting on frontiers of nonperturbative field theory: Lattice fields and strings; Eger, Hungary (18 Aug 1988).

Introducing a lattice equivalent of a current coupling to the gauge potential, we study various abelian Higgs models in the background of constant external electromagnetic field strengh tensors. As expected from the analogy to superconductivity in terms of the phenomenological Ginzburg-Landau Lagrangian, a variety of interesting effects is observed: A relativistic generalization of the Meissner effect, a vortex-populated region of the Higgs phase, and the restoration of a 'normal' Coulomb phase from the Higgs phase once the external field is strong enough.

13850 (SLAC—333) The application of light-cone quantization to quantum chromodynamics in one-plus-one dimensions. Hornbostel, K.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1988. Contract AC03-76SF00515. 162p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006019/JAW.

Formal and computational aspects of light cone quantization are studied by application to quantum chromodynamics (QCD) in one spatial plus one temporal dimension. This quantization scheme, which has been extensively applied to perturbative calculations, is shown to provide an intuitively appealing and numerically tractable approach to non-perturbative computations as well. In the initial section, a light-cone quantization procedure is developed which incorporates fields on the boundaries. This allows for the consistent treatment of massless fermions and the construction of explicitly conserved momentum and charge operators. The next section, which comprises the majority of this work, focuses on the numerical solution of the light-cone Schrodinger equation for bound states. The state space is constructed and the Hamiltonian is evaluated and diagonalized by computer for arbitrary number of colors, baryon number and coupling constant strength. As a result, the full spectrum of mesons and baryons and their associated wavefunctions are determined. These results are compared with those which exist from other approaches to test the reliability of the method. The program also provides a preliminary test for the feasibility of, and an opportunity to develop approximation schemes for, an attack on three-plus-one dimensional QCD. Finally, analytic results are presented which include a discussion of integral equations for wavefunctions and their endpoint behavior. Solutions for hadronic masses and wavefunctions in the limits of both large and small quark mass are discussed. 49 refs., 32 figs., 10 tabs.

13851 (WUB-DI—85-3) Mean-field perturbation theory for the U(1) and the SU(2) lattice gauge theory. Schlichting, H. (Wuppertal Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 8 - Naturwissenschaften 1 - Physik). Mar 1985. 134p. (In German). library of Wuppertal Univ. (Gesamthochschule) (Germany, F.R.).

The $1/\beta$/sup 2/-term of the weak coupling expansion for the plaquette in pure SU(2) lattice gauge theory is determined by doing a two loop calculation in mean field perturbation theory. Special attention is being payed to an ambiguity introduced by the formula-

tion of mean field as a saddle point expansion. Next a linearised version of mean field is formulated, in which quadratic variables are treated independently and in which this ambiguity does not occur. This method is applied to the pure U(1) and to the mixed fundamental adjoint SU(2) lattice gauge theory in four dimensions showing that results for the free energy and the mean plaquette are improved as compared with former mean field calculations.

13852 **Issues in QCD and properties of the Y system.** Fulcher, L.P. (Department of Physics and Astronomy, Bowling Green State University, Bowling Green, Ohio 43403-0224). *Physical Review [Section] D: Particles and Fields;* **39**: No. 1, 295-304(1 Jan 1989).

Recent results from lattice gauge theory and Gromes's consistency condition are used to determine the long-range (nonperturbative) spin-orbit potential. An important characteristic of this potential is that its sign is opposite to that of the leading perturbative contribution from one-gluon exchange. Moreover, this sign can be established without additional assumptions about the nature of the confining potential. Experimental support for this claim is garnered from the ratios of the fine-structure splittings of the Y system. Results for the energies, splittings, leptonic widths, and dipole transition rates are presented from a calculation based on full one-loop perturbative potentials supplemented by a linear confining potential and the long-range spin-orbit potential. Some of the assumptions about the nature of the renormalization scale and strong coupling constant are explored, and a procedure for finding the optimum values of these parameters is developed. The value of the strong coupling constant obtained in this manner is found to agree remarkably well with that obtained from gluon annihilation rates. Frequent comparison with the results and viewpoints of Gupta, Radford, and Repko, and Kwong and Rosner are carried out.

13853 **QCD effects on B/sup 0/ - B-bar/sup 0/ mixings for various values of the top mass.** Kaufman, W.A. (Dept. of Physics, The Univ. of Colorado, Boulder, CO (US)); Steger, H. (Deutsches Elektroner Synchrotron - DESY, Hamburg (DE)); Yao, Y.P. (Dept. of Physics, The Univ. of Michigan, Ann Arbor, MI (US));. *Modern Physics Letters B;* **3**: No. 15, 1479-1488(Nov 1988).

The authors consider QCD effects on B^0 - B-bar^0 systems when m/sub t/ $\approx$ m/sub w/ and m/sub t/ $>>$ m/sub w/, where m/sub t/ and m/sub w/ are the masses of the top quark and the charged W bosons, respectively. They are markedly different from naive extrapolations of formulae valid for m/sub t/ $<<$ m/sub w/. The authors then apply their results to the ARGUS B/sub d/^{0} - B-bar/sub d/^{0} mixing and obtain a lower bound m/sub t/ $>$ 55 GeV.

65 PHYSICS II

13854 **(LYCEN—8801) Annual report of the Universite Claude Bernard Institute of Nuclear Physics.** (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). 1988. 181p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88756687/JAW.

Research in theoretical physics; high and intermediate energy physics; nuclear physics; and interdisciplinary physics is presented.

6510 Nuclear Physics

13855 **(ENEA-RT-TIB—87-46) Contributions to the International conference on nuclear structure, reactions and symmetries.** Ventura, A.; Maino, G. (and others). (ENEA, Rome (Italy)). Mar 1988. 20p. (CONF-8606130—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755376/JAW.

From International conference on nuclear structure, reactions, and symmetries; Dubrovnik, Yugoslavia (5 Jun 1986).

Reprinted from the Proceedings of the Conference edited by R.A. Meyer and V. Paar, published by World Scientific Publ. Co., Singapore, 1986, by permission of the Publisher.

The present report contains two invited papers presented at the International Conference on Nuclear Structure, Reactions and Symmetries, Dubrovnik, 5-14 June 1986. The papers investigate, within the framework of the interacting boson model for the excitation of the giant dipole resonance, photon scattering by non-magic even-even nuclei and present an algebraic approach to giant resonances. Schematic calculations are described for two transitional isotope chains Pd and Sm.

13856 **(GSI—88-1) GSI scientific report 1987.** Grundinger, U. (ed.). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Mar 1988. 474p. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88754832/JAW.

In this annual report extended abstracts are presented of the work performed at the named institute. They are concerned with nuclear structure studies of exotic nuclei and high spin states, heavy ion reactions, nuclear theory, positron production in heavy ion collisions, radiation effects in biological systems and solids, nuclear chemistry, experimental techniques, and accelerator developments. (HSI).

13857 **(INDC(NDS)—207/L) Measurement and analysis of 14 MeV neutron-induced double-differential neutron emission cross sections needed for fission and fusion reactor technology. Summary report of the first research co-ordination meeting held in Vienna, 20-22 April 1988.** Wang Dahai; Mehta, M.K. (International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section). (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jul 1988. 15p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705102/JAW.

The main objectives of this IAEA Co-ordinated Research Programme are to improve the current status of data for 14 MeV neutron-induced double-differential neutron emission cross sections for V, Cr, Fe, Nb, Ta and /sup 238/U. The principal objectives of this first meeting were to report on the status of participants' work, to exchange experience in experimental work and to establish the future work. Considering the unsatisfactory status of the data for / sup 6/Li, /sup 7/Li, /sup 9/Be, Mo, W and Bi and their importance in fusion reactor technology participants agreed to include these isotopes in the programme.

13858 (INIS-SU—68, pp 371) **Obtaining information on a mechanism of α-particle emission in the /sup 20/Ne, /sup 40/Ar + Ge reactions by means of shadow effect.** Bugrov, V.N.; Epifanenkov, F.E.; Karamyan, S.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13859 (INIS-SU—68, pp 446) **Mechanism of elastic and inelastic scattering of fast neutrons at excitation of low-lying levels of $48 \leqq A \leqq 140$ nuclei.** Korzh, I.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13860 (INIS-SU—68, pp 360) **Experimental investigations of neutron-rich nuclei of light elements in heavy ion reactions.** Penionzhkevich, Yu.Eh. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 12747, 13795, 14068

13861 **(AD-A—199990/3/XAB) Physics of spin-polarized atomic vapors. Final technical report, 1 October 1986-30 April 1988.** Happer, W. (Princeton Univ., NJ (USA)). 26 May 1988. 4p. NTIS, PC A02/MF A01.

Research efforts were focussed on the study of spin polarized atoms, nuclei, and electrons during the period covered by this report. Although this work is basic research, it has applications to a number of important Air Force problems. For example, the atomic clocks used on the GPS satellite system operate with optically pumped rubidium absorption cells, very similar to the ones being investigated. A number of the scientists and engineers working on atomic clocks used by Air Force satellite systems were trained with the support of this grant. This laboratory participated in recent Air Force advisory panels to review concepts for high-energy-density fuels based on spin-polarized atoms and molecules. The insights gained from research sponsored by this grant have been very useful in evaluating these ideas. Recent work has focused on two main areas, the investigation of quadrupolar interactions between spin-polarized noble-gas nuclei and surfaces and the quantitative investigation of how magnetic-field inhomogeneities cause spin relaxation.

13862 (DOE/ER/40363—T2) Studies of relativistic heavy ion collisions at the AGS (Experiment 814): Progress report, 1 May 1988--30 April 1989. Cleland, W.E.; Thompson, J.A. (Pittsburgh Univ., PA (USA). Dept. of Physics and Astronomy). [1989]. Contract FG02-87ER40363. 43p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005894/JAW.

During this year, the Pittsburgh group has been working with the collaboration (BNL and CERN) in building the final apparatus for experiment 814 at the Brookhaven AGS. In May 1987, during the heavy ion run at the AGS, we mounted a test setup, which was used to understand the behavior of the modified uranium/scintillator calorimeters, to test the prototype Z-counters, to carry out a set of albedo measurements, and to carry out a measurement of the E/sub T/ spectrum for a 10 GeV/nucleon beam incident upon a variety of nuclear targets. Preliminary results from this run indicate that there is almost complete stopping of the ions at 10 GeV/nucleon, as the limit in E/sub T/ reached seems to depend little on the A of the target nucleus. This paper gives a brief description of the status of the various elements of the experiment and a brief discussion of the expansion of the E814 program to include a search for strange matter. Details on the equipment being built by the Pitt group are also given.

6512 Nuclear Properties And Reactions, A=1-5, Experimental

13863 (CONF-880983—33) Polarized deuteron target in an electron storage ring: Measurements and perspectives. Mishnev, S.I.; Nikolenko, D.M.; Popov, S.G.; Rachek, I.A.; Temnykh, A.B.; Toporkov, D.K.; Tsentalovich, E.P.; Vesnovsky, D.K.; Wojtsekhowski, B.B.; Zelevinsky, V.G. (Argonne National Lab., IL (USA); AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1988. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005890/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

A gas jet of polarized deuterium atoms with a thickness of 2 {times} 10^{11} cm/sup {minus}2/ has been used as an internal target in the VEPP-3 electron storage ring with 2 GeV energy. Source characteristics as well as experimental conditions and results on elastic and inelastic scattering are reviewed. Results of experimental studies and calculations of jet depolarization induced by an electron beam are discussed. For the first time a storage cell for polarized atoms was used in the storage ring in order to increase the target thickness. Depolarization of atoms inside the cell due to wall collisions with a drifilm surface and a magnetic field is proved to be small whereas depolarization due to the transitional magnetic field of the electron beam at 2 GeV energy can be significant. Conditions for small depolarization by the electron beam were found. An effective target polarization in the storage cell was found to be P/sub zz//sup eff/=0.8+-0.2. 17 refs., 13 figs., 2 tabs.

13864 (INS—706) Hypernucleus formation in high-energy nuclear collisions. Sano, M. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Sep 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756545/JAW.

A coalescence model is used to estimate the hypernucleus and H-particle formation probabilities in nuclear collisions. The hypernuclear formation in collisions of relativistic beams of /sup 4/He, /sup 7/Li, /sup 12/C and /sup 19/F with target of /sup 12/C is calculated at energies used in the recent Dubna experiment. The secondary (π/sup +/K/sup +/) formation is also evaluated and found to be non-negligible. The formation cross section of H-particle is of the order of magnitude of μb in the Ne-Ne collisions at 5 GeV/nucleon.

6513 Nuclear Properties And Reactions, A=6-19, Experimental

13865 (ANL-HEP-CP—88-72) Dynamic polarization of ^{19}F in a fluorinated alcohol. Hill, D.; Kasprzyk, T.; Jarmer, J.J.; Penttilae, S.; Krumpolc, M.; Hoffmann, G.W.; Purcell, M. (Argonne National Lab., IL (USA); Texas Univ., Austin (USA)). 1988. Contract W-31109-ENG-38;AS05-80ER10638. 8p. (CONF-880983—29). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005854/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

We have studied microwave dynamic cooling of ^{19}F and ^{1}H nuclei in mixtures of 1,1,1,3,3,3-hexafluoro-2-propanol and water, doped with Cr(V) complex. Equal spin temperatures of the two nuclei are produced, and the highest spin polarizations ({approximately}80%) are found in mixtures near the eutectic ratio. The high fluorine content and polarization make this a suitable material for polarized nuclear scattering experiments. 11 refs., 3 figs., 1 tab.

13866 (ANL/NDM—108) Some comments on the interaction of fast-neutrons with beryllium. Sugimoto, M.; Guenther, P.T.; Lynn, J.E.; Smith, A.B.; Whalen, J.F. (Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38. 31p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005754/JAW.

Neutron total cross sections of elemental beryllium were measured from 1 to > 10 MeV with good precision. Differential neutron elastic-scattering cross sections were measured from 4.5 to 10 MeV at energy intervals of ~0.5 MeV, and for ~ 100 angular steps distributed between 18{degree} and 160{degree} at each incident energy. Concurrently, differential cross sections for the emission of a discrete inelastic-neutron group corresponding to an excited level at 2.43 +- 0.06 MeV were determined over the same incident-energy and angular range. Angle-integrated elastic-scattering cross sections were deduced from the observed differential values to accuracies of 2.5%, and angle-integrated inelastic-scattering cross sections were established to accuracies of ≦ 10%. The experimental results are compared with values given in ENDF/B-V, with attention to discrepancies and implications. Qualitative reaction mechanisms are suggested. 27 refs., 8 figs., 1 tab.

6514 Nuclear Properties And Reactions, A=20-38, Experimental

13867 (INIS-SU—68, pp 368) Mechanisms of the (/sup 14/N,Li) and (/sup 14/N,B) reactions on /sup 27/Al and /sup 28/Si nuclei at E(/sup 14/N) = 150 MeV. Aushev, V.E.; Goryunov, O.Yu.; Zaika, N.I. and others. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13868 (INS—700) Quasi-molecular states in sd-shell nuclei. Kubono, S.; Ikeda, N.; Nomura, T. and others. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Aug 1988. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756541/JAW.

Quasi-molecular states near and below the threshold of the molecular configuration in sd-shell nuclei are discussed using recent experimental data with particle-gamma coincidence method and particle-particle coincidence method. Possible quasi-molecular states

have been identified in /sup 24/Mg as well as in /sup 28/Si and /sup 32/S. The important role of quasi-molecular states are discussed, specifically for the shape evolution of nuclei as a function of excitation energy and angular momentum.

6515 Nuclear Properties And Reactions, A=39-58, Experimental

13869 **(DOE/ER/40150—51) Relativistic nuclear physics with the spectator model.** Gross, F. (Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility). 1988. Contract AC05-84ER40150. 22p. (CEBAF-PR—88-011; CONF-880758—9). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005550/JAW.

From Workshop on nuclear and particle physics on the light cone; Los Alamos, NM, USA (18 Jul 1988).

The spectator model, a general approach to the relativistic treatment of nuclear physics problems in which spectators to nuclear interactions are put on their mass-shell, will be defined nd described. The approach grows out of the relativistic treatment of two and three body systems in which one particle is off-shell, and recent numerical results for the NN interaction will be presented. Two meson-exchange models, one with only 4 mesons (π, σ, {rho}, ω) but with a 25% admixture of γ^5 coupling for the pion, and a second with 6 mesons (π, σ, {rho}, ω, δ, and {eta}) but a pure $\gamma^5\gamma$/sup mu/ pion coupling, are shown to give very good quantitative fits to NN scattering phase shifts below 400 MeV, and also a good description of the {rho} $^{40}C\alpha$ elastic scattering observables. 19 refs., 6 figs., 1 tab.

6516 Nuclear Properties And Reactions, A=59-89, Experimental

13870 **(INIS-mf—11890) Oblate nuclear deformation in /sup 69,71/Se.** Wiosna, M. (Koeln Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 7 May 1988. 126p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756504/JAW.

In the extremely neutron-deficient nucleus /sup 69/Se for the first time excited levels could be identified via the reaction /sup 40/Ca(/sup 32/S,2pn) at E(/sup 32/S) = 100 MeV. γ single spectra, γ excitation functions, γ angular distributions, and k conversion coefficients were measured. In all measurements the neutron-multiplicity filter was applied in order to obtain the corresponding spectra also in coincidence to the neutrons evaporated from the compound nucleus. The $\gamma\gamma$ coincidences were also measured by application of the 11-fold OSIRIS spectrometer. The identification of excited levels in /sup 69/Se was also confirmed via the following cross-bombardment reactions: /sup 40/Ca(/sup 36/Ar,α2pn)/sup 69/Se at E(/sup 36/Ar) = 145 MeV, /sup 58/Ni(/sup 14/N,p2n)/sup 69/Se at E(/sup 14/N) = 53 MeV, and /sup 58/Ni(/sup 16/O,αn)/sup 69/Se at E(/sup 16/O) = 65 MeV. A term scheme with 21 levels could be established whereby for 11 levels the spin could be assigned. The level scheme of the neutron-deficient nucleus /sup 71/Se could be extended by 23 levels by a $\gamma\gamma$ coincidence measurement with the 10-fold OSIRIS spectrometer in the reaction /sup 58/Ni(/sup 16/O,2pn)/sup 71/Se at E(/sup 16/O) = 65 MeV, whereby for 9 of these levels a spin assignment could be met. From the sign of the experimentally determined mixing ratio of the M1/E2 radiation for the 11/2/sup +/ -> 9/2/sup +/ transitions in both nuclei an oblate deformation of the g/sub 9/2/ band could be derived. The experimentally found excitation structures could be essentially reproduced by calculations in the particle + asymmetric-rotor model respectively in the cranked shell model and their physical properties understood.

6517 Nuclear Properties And Reactions, A=90-149, Experimental

13871 **(CONF-8806167—6) Sub-barrier reactions measured using a recoil mass separator.** Betts, R.R. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005803/JAW.

From Symposium on heavy ion interactions around the Coulomb Barrier; Padova, Italy (1 Jun 1988).

Few data exist in the sub-barrier region for reaction channels other than fusion. In particular, our experimental knowledge of quasi-elastic transfer reactions is sparse, despite the belief that this particular channel may be dominant in determining some features of the sub-barrier fusion enhancement. Transfer reactions are governed primarily by the closet approach of the colliding nuclei which, at low energies, results in a strong backward peaking of the angular distribution in the center-of-mass frame. For situations where the projectile has a significant fraction of the target mass, as is so in most cases of interest, the backscattered projectile-like fragment has such low energy that the usual techniques of measurement and identification become invalid. Here, we report on a solution to this problem which allows a systematic study of many aspects of transfer reactions in the energy regime of interest. We exploit the fact that associated with the low-energy backscattered projectile-like fragment is a complementary target-like fragment which recoils to forward angles with a large fraction of the incident beam energy. These target-like fragments were detected and identified using the Daresbury Recoil Mass Separator thus allowing the measurement of quasi-elastic transfer over hitherto inaccessible energy range from the vicinity of the barrier to several tens of MeV below. The experiments described here used ^{58}Ni beams of energies ranging from 180 to 260 MeV provided by the Daresbury Laboratory Nuclear Structure Facility tandem accelerator. Data on sub-barrier transfer for targets of /sup 116,118,120,122,124/Sn and /sup 144,148,150,152,154/Sm were obtained. 16 refs., 10 figs., 2 tabs.

13872 **(LUIP—8703) Maximum breakup of symmetric and asymmetric heavy ion reactions between 5A and 2100A MeV.** Jakobsson, B.; Joensson, G.; Karlsson, L. (Lund Univ. (Sweden). Dept. of Cosmic and Subatomic Physics). Jun 1987. 14p. (LUNFD6-NFFK—7079-1-14-1987). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756198/JAW.

The maximum breakup of /sup 16/O + /sup 107/Ag and /sup 84/Kr + /sup 107/Ag collisions at energies from 5A to 2100A Mev has been investigated. Comparisons between data and calculations within a fusion + evaporation model at low energies and fusion + hadrochemical fireball decay model at higher energies show that phenomena like pre-equilibrium emission, compression and collective flow must be considered. At 34+-2A MeV we observe the cease of the compound evaporation process and the onset of multifragmentation for the highest multiplicity /sup 16/O + /sup 107/Ag collisions. (authors).

6518 Nuclear Properties And Reactions, A=150-189, Experimental

13873 **(DOE/ER/40330—25) Nuclear structure from radioactive decay: Annual progress report.** Wood, J.L. (Georgia Inst. of Tech., Atlanta (USA). School of Physics). 30 Sep 1988. Contract FG05-87ER40330. 23p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005904/JAW.

The primary focus this year has been the continuing studies of intruder states and shape coexistence in the neutron-deficient Z {approximately} 82 region. Most notably, an extensive region of odd-mass nuclei is emerging within which low-lying low-energy electric monopole (EO) transitions occur. This is a completely new nuclear structure phenomenon. The empirical results are based on on-line decay scheme spectroscopy of mass-separated isotopes at UNISOR. In particular, many transition multipolarities are determined from conversion electron subshell ratios observed in γ-gated electron coincidence spectra. This is a completely new nuclear spectroscopic technique. To cite a specific example: our studies of the $^{185}Au \rightarrow {}^{185}Pt$ decay scheme reveal at least 11 transitions with EO components. This is unprecedented in nuclear structure. The role of EO transitions is being pursued in the larger framework of a signature of shape coexistence in nuclei.

13874 **(DOE/ER/40404—T1) Nuclear chemistry progress report, [August 1, 1987--July 31, 1988].** (Indiana Univ., Bloomington (USA)). Aug 1988. Contract FG02-88ER40404. 66p. (INC—40007-55). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE88016899/JAW.

The activities of the Nuclear Chemistry program at Indiana University during the period of August 1, 1987 to July 31, 1988 are summarized in this report. The primary focus of this experimental program is: the study of nucleon-exchange and excitation-energy division between projectile-like and target-like fragments in damped collisions just above the interaction barrier, and characterization of the mechanisms of energy and momentum dissipation in intermediate-energy collisions, with emphasis on complex fragment emission and the relative contributions of fully equilibrated and non-equilibrated processes. The objective of this research has been to improve our understanding of the time evolution of energy and matter flow in collisions between complex nuclei and the behavior of highly excited nuclear matter. Our work during 1987-1988 has been based primarily on work at the LBL SuperHILAC, the National Superconducting Cyclotron Laboratory at Michigan State University, the Indiana University Cyclotron Facility, and the Saturne accelerator in Saclay, France.

13875 (INIS-SU—68, pp 323) **Isomer ratio in the /sup 185/Re(γ,n)/sup 184m,g/Re reactions.** Vishnevskij, I.N.; Zheltonozhskij, V.A.; Lomonosov, V.I.; Mazur, V.M.; Reshit'ko, S.V.; Sokolyuk, I.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13876 (Juel-Spez—458, pp 1-98) **Studies on the decay of high-spin isomers in the W and Os isotopes.** Kraemer-Flecken, A. Jul 1988. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756513/JAW.

In Studies on the decay of high-spin isomers in the W and Os isotopes and developments of programs for the guidance of the experimental logics and the data acquisition.

From the two experiments performed on the nucleus /sup 180/Os the properties of the new high-spin isomer could be found. The excitation energy amounts to 5208 keV and the spin of the isomer amounts probably to I=19Planck constant. The new measured half-life amounts to T/sub 1/2/=41+-10 ns. It is populated with an intensity of 1.6+-0.4% relative to the (4 + -> 2 +) transition in the Yrast band in an experiment with out use of the recoil-shadow technique. A preliminary decay scheme could be established from the sum spectra and exhibits similarities with the decay of the high-spin isomer in /sup 182/Os. From the analysis of the experiment on the nucleus /sup 178/W a new isomer with an excitation energy of 5271 keV and a half-life of T/sub 1/2/=39+-10 ns could be identified. The spin of the level has been determined to I=20+-1. The half-life of the 3527 keV isomer has been determined to T/sub 1/2/=28+-4 ns. The spin of the isomer could be determined from the analysis of DCO ratios to I/sup π/=14/sup -/. The configuration of the isomer could be fixed to ν6 + 5/2 -/sup 5/512/sup 7/ x 7/2 /sup 5/514/sup 7/ +π8 - 7/2 +/sup 5/404/sup 7/ x 9/2 /sup 5/514/sup 7/ because of the comparison with the 14/sup -/ isomer in /sup 176/Hf and the comparison of the excitation energy for certain configurations with I/sup π/=14/sup -/. (orig./HSI).

6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

13877 **(INIS-BR—1373) Multipole components of /sup 235/U photofission.** Carvalheiro, Z. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). 1985. 81p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705169/JAW.

The absolute electrofission cross section for /sup 235/U has been experimentally obtained in the energy range 5.8 - 18.0 MeV, using the electron beam of the Linear Accelerator of Institute of Physics of the University of Sao Paulo. From a combined analysis of this cross section and a previously measured photofission cross section, using virtual photon spectra calculated in the Distorted Wave Born Approximation (DWBA), the " non electric dipole photofission" cross section σ/sup NDE//sub γ,f/ (ω) has been obtained, which contains all multipolarities allowed by the reaction Kinematics, except El. This cross section presents a resonant shape, probably associated with the Giant Quadrupole Resonance (GQR). Once the fission channel exhausts a great amount of the Energy Weighted Sum Rule (EWSR), it is therefore the major decay mode of the GQR. All these aspects agree with the ones verified for the other Uranium isotopes previously analysed in this Laboratory.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 13795, 13855, 13865

13878 **(ANL-HEP-CP—88-28) Some implications of a possible NNπ bound state.** Lipkin, H.J. (Argonne National Lab., IL (USA)). 23 Jun 1988. Contract W-31109-ENG-38. 8p. (CONF-8805142—47). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005845/JAW.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

The possible properties of a πNN bound state are considered, in view of recent reports of possible experimental evidence for such a state. A six-quark T=2 state is shown not to be bound. Strong, electromagnetic and weak decays are examined for a πNN bound state with a mass below the πNN threshold and the cases of isospin T=2,1 or 0. States in these multiplets with charge 0,1 and 2 have interesting properties and might be observed as narrow resonances decaying electromagnetically, in particular states with J/sup P/ = 1+ with charge 0 and 2 which are Pauli-forbidden for two nucleons. The lifetimes of the charge {minus}1 and +3 states should be much longer than the pion lifetime because of drastically reduced phase space. 10 refs.

13879 **(BONN-IR—88-04) W-matrix treatment of the deuteron photodisintegration.** Ferber, C. von. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Feb 1988. 65p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756493/JAW.

This thesis deals with the deuteron photodisintegration under the special aspect of the treatment with the non-singular W-matrix integral equations. In the 1. chapter foundations on the electromagnetic interaction are listed and especially the use of gauge invariance respectively charge conservation by means of the Siegert theorem explained. Then a multipole expansion is performed. This is presented as expansion of the interaction Hamiltonian in creation and annihilation operators of photon states with defined angular-momentum and parity quantum numbers. By this the matrix elements of the interaction operator can be given in the energy-angular momentum representation which describe the transition probability in 1. order perturbation theory according to Fermi's golden rule. In the chapter 'W-matrix' then the methods are derived by which these transition matrix elements can be calculated or determined approximatively. How from the transition amplitudes cross sections and polarization are to be determined is described in chapter 4. There explanations are found how this problem is to be treated by means of density matrices and polarization tensors. A chapter follows which deals with the numerical problems which occurred in the calculations for this thesis. (orig./HSI).

13880 **(CONF-880496—5) Two-neutron transfer reactions with heavy-deformed nuclei.** Price, C.; Landowne, S.; Esbensen, H. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005848/JAW.

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

In a recent communication we pointed out that one can combine the macroscopic model for two-particle transfer reactions on deformed nuclei with the sudden limit approximation for rotational excitation, and thereby obtain a practical method for calculating transfer reactions leading to high-spin states. As an example,

we presented results for the reaction $^{162}Dy(^{58}Ni,^{60}Ni)^{160}Dy$ populating the ground-state rotational band up to the spin $I = 14^+$ state. We have also tested the validity of the sudden limit for the inelastic excitation of high spin states and we have noted how the macroscopic model may be modified to allow for more microscopic nuclear structure effects in an application to diabolic pair-transfer processes. This paper describes our subsequent work in which we investigated the systematic features of pair-transfer reactions within the macroscopic model by using heavier projectiles to generate higher spins and by decomposing the cross sections according to the multipolarity of the transfer interaction. Particular attention is paid to characteristic structures in the angular distributions for the lower spin states and how they depend on the angular momentum carried by the transferred particles. 11 refs., 3 figs.

13881 **(CONF-8805140—11) Theory of high-energy electron scattering by composite targets.** Coester, F. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005842/JAW.

From International conference on medium- and high-energy nuclear physics; Taipei, Taiwan (23 May 1988).

The emphasis of these expository lectures is on the role of relativistic invariance and the unity of the theory for medium and high energies. Sec. 2 introduces the kinematic notation and provides an elementary derivation of the general cross section. The relevant properties of the Poincare group and the transformation properties of current operators and target states are described in Sec 3. In Sec. 4 representations of target states with kinematic light-front symmetry are briefly discussed. The focus is on two applications. An impulse approximation of inclusive electron nucleus scattering at both medium and high energies. A parton model of the proton applied to deep inelastic scattering of polarized electrons by polarized protons. 19 refs.

13882 **(DOE/ER/10407—9) Theoretical nuclear reaction and structure studies using kaons and photons: Final technical report, June 1, 1979--September 1, 1988.** Cotanch, S.R. (North Carolina State Univ., Raleigh (USA). Dept. of Physics). 1988. Contract AS05-79ER10407. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006042/JAW.

The research topics of this program have involved several sectors of nuclear and particle physics. In addition to studying reactions involving kaons and photons{endash}a project treating K+ meson elastic scattering, K+ photo and electroproduction, hypernuclear photo-excitation and photo-proton knockout reactions with delta isobar formation, this research program has also investigated symmetry principles and their usefulness in reaction theory. This paper provides a brief overview of the major scientific findings and cite key, representative publications containing full details.

13883 **(DOE/ER/40154—4) Research in theoretical nuclear physics: Progess report, 1 December 1987--30 November 1988.** Liu, Keh-Fei. (Kentucky Univ., Lexington (USA)). 1988. Contract FG05-84ER40154. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005950/JAW.

Several projects on the lattice gauge Monte Carlo calculations are completed. The decay constants for vector and pseudoscalar mesons are calculated with both Wilson and staggered fermions. In this way, the fermion universality is checked. A study is made to measure the axial vector coupling of the nucleon. The ratio of the g/sub A//g/sub V/ is measured to be about 1.1 which is close to the experimental value. The pion form factor is measured in SU(3) for the first time with a beta value of 5.9. We have made a breakthrough on the identification of the tensor meson this past year. By incorporating a soft form factor, we can show that $\theta(f_2(1720))$'s decay pattern is flavor independent. Other experimental results lend their strong support for such a form factor. There are two experiments which indicate that there are essentially no quarks in θ. In the context of QCD, we conclude that θ must be a tensor glueball. We also used the tensor dominance model to calculate the branching ratio of the tensor glueball in J/{psi} radiative decay. On the front of skyrmion, we have shown that there is an isosinglet axial vector current in the Skyrme model. Its integral is simply the spin operator. Thus we show that there is no relation between the skyrmion and the quark helicity deduced from the recent EMC experiment on the spin structure of the proton. A Ph.D. student is finishing up his thesis on the Skyrmion-Landau parametrization of the N-N interactions. The results on the two particle spectra of ^{18}O and ^{18}F show that we still need a tensor force. The controversy over the damping of color oscillations in a quark gluon plasma is resolved through a gauge-invariant linear-response analysis. It is speculated that the quark gluon phase is non-perturbative no matter how high the temperature is. Topological non-abelian phases are bound in gauge theories with chiral fermions.

13884 **(DOE/ER/40406—2) Investigations of nuclear structure and nuclear reactions induced by complex projectiles: Progress report, January 1, 1988 through December 1, 1988.** Sarantites, D.G. (Washington Univ., St. Louis, MO (USA). Dept. of Chemistry). 1988. Contract FG02-88ER40406. 62p. NTIS, PC A04/MF A01. Order Number DE89000034/JAW.

This progress report contains papers on the following topics: fusion reactions, binary heavy-ion reactions, multifragmentation reactions, nuclear structure studies, and instrumentation and analysis. (LSP)

13885 **(ENEA-RT-FUS—87-31) Proton-nuclide reaction cross sections. A collection of data from literature.** Robouch, B.V.; Gentilini, A. (ENEA, Frascati (Italy). Centro Ricerche Energia; ENEA, Rome (Italy). Direzione Sicurezza Nucleare e Protezione Sanitaria). (ENEA, Rome (Italy)). 1988. 68p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705245/JAW.

Encouraged and stimulated by the request of the previous, similar report on D-reactions, the authors decided to issue a collection of the present report as a handy source of data, collected through a systematic bibliographic research from available, fragmentary data on proton-nuclide reaction cross sections. The data covers 35 elements with 95 reactions relative to 54 nuclides. The whole set of values has been fed into the ENEA compute network as a subroutine PXSECT giving on-line the value of the cross section of the available reactions and energy ranges; the instructions for the use of the subroutine are specified. The cross section data is presented in both tabular and graphical forms. All the literature sources are duly reported in the references. The authors would appreciate receiving and further, new documentation as to proton-nuclide reaction cross sections to up date the data bank and reissue rectifications and updates to correspondants. 106 refs.

13886 **(GSI—88-57-Prepr.) Dissipation and friction in nuclear fission.** Hasse, R.W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Nov 1988. 10p. (CONF-881149—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756496/JAW.

From 18. international symposium on nuclear physics (ISNP-18) - physics and chemistry of fission devoted to the 50. anniversary of the discovery of nuclear fission; Gaussig, German D.R. (21 Nov 1988).

We give a short review on experimental evidence for dissipation in nuclear fission as well as on the development of theories of nuclear dissipation and friction applied to the fission process. Theories span from two-body viscosity and one-body dissipation via the time dependent Schroedinger equation to linear response theory and the Fokker-Planck equation.

13887 (INIS-SU—68, pp 169) **Electron scattering and a structure of sd-shell nuclei.** Gul'karov, I.S. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13888 (INIS-SU—68, pp 183) **Microscopic description of E0- and E2-transitions in even-even and odd deformed nuclei.** Nesterenko, V.O. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13889 (INIS-SU—68, pp 262) **On the probability of one-photon de-excitation by E0-transitions in oriented nuclei.** Kuzhir, P.G.; Tesevich, B.I.; Trofimenko, E.E. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13890 (INIS-SU—68, pp 442) **Account of antisymmetrization effects when spectroscopic information is extracted from analysis on DWBA of the (p, α) reaction.** Bekbaev, S.M.; Gulamov, I.R.; Kim, G.; Mukhamedzhanov, A.M.; Ni, G.K.; Chuvil'skij, Yu.M. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13891 (INIS-SU—68, pp 467) **Bremsstrahlung in heavy ion reactions.** Denisov, V.Yu.; Plyujko, V.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13892 (INIS-SU—68, pp 246) **Effect of second - class currents and neutrino rest mass on characteristics of β - decay process of mirror nuclei.** Al'-Mamma, Z.A.K.; Kerimov, B.K.; Samsonenko, N.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13893 (INIS-SU—68, pp 269-270) **Structure of the roentgen LX spectra of Pb and Np.** Sergienko, V.A.; Shil'nikov, O.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13894 (INIS-SU—68, pp 416) **Partial decay probabilities of excited heavy nuclei.** Fotina, O.V.; Yuminov, O.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

13895 (INS—703) **Master equations in the microscopic theory of nuclear collective dynamics.** Sakata, Fumihiko; Matsuo, Masayuki; Marumori, Toshio; Zhuo, Yizhong. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Sep 1988. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756543/JAW.

In an isolated finite many-body quantal system as the nucleus in which the self-consistent mean field is realized, collective modes of motion (associated with time evolution of the mean field) are highly involved with non-collective modes of motion in a strongly self-consistent way. By paying attention to this strong self-consistency, a general microscopic framework is given to derive master equations which enable us to investigate various dynamical mechanism of the nuclear large-amplitude collective motion. The theory consists of two ingredients: (i) Introduction of a dynamical canonical coordinate (DCC) system, where the whole nuclear dynamics is optimally described in terms of the collective (relevant) and the non-collective (irrelevant) variables in a self-consistent way on the basis of the self-consistent collective coordinate (SCC) method. (ii) Application of the time-dependent projection operator method of Willis and Picard to the Liouville equation in the DCC system. This application makes it possible to treat both time evolution of a reduced distribution function for the relevant variables and that of a reduced distribution function for the irrelevant variables in a self-consistent way, without introducing any statistical hypothesis for the reduced irrelevant distribution function. The general coupled master equations in the DCC system thus obtained are rich enough to explore what is microscopic mechanism responsible for dissipative behaviour of the large-amplitude collective motion, in connection with stability problem of the collective subspace obtained by the SCC method.

13896 (IPNO-TH—87-74) **Introduction to the cluster formation theory. Application to the nuclear fragmentation reactions.** Campi, X. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1987. 48p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756683/JAW.

This course reviews the theory of geometrical models of cluster formation in nuclear reactions. After an elementary introduction to the theory of critical phenomena, illustrated by percolation models, we discuss kinetic theories of aggregation and fragmentation. The realization of these ideas in the context of nuclear fragmentation reactions and the search of signals of phase transitions is also reviewed.

13897 (PEL—286) **GRAP-gamma ray allocation program - a user's guide.** Franklyn, C.B. (Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria). May 1985. 58p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705215/JAW.

In Fortran ivx and for minicomputer.

The Gamma Ray Allocation Program, together with two auxilliary programs, is used for generating a consistent nuclear level scheme from gamma ray transition energies. It is basically designed to deal with neutron capture gamma ray data, but can be applied to a variety of other problems. The main program is interactive and allows for both extensive and tentative manipulation of transition allocations, giving an immediate overall picture of the consequences to the level scheme of such manipulation. A detailed description of how to use the program for developing a level scheme is presented.

13898 (UCRL—99956) **Spontaneous fission properties of the heavy elements: Bimodal fission.** Hulet, E.K. (Lawrence Livermore National Lab., CA (USA)). 11 Nov 1988. Contract W-7405-ENG-48. 11p. (CONF-881149—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005650/JAW.

From 18. international symposium on nuclear physics (ISNP-18) - physics and chemistry of fission devoted to the 50. anniversary of the discovery of nuclear fission; Gaussig, German D.R. (21 Nov 1988).

We have measured the mass and kinetic-energy distributions from the spontaneous fission of ^{258}Fm, ^{258}No, ^{259}Md, ^{260}Md, ^{260}[104], and ^{262}No. All are observed to fission with a symmetrical division of mass, whereas the total-kinetic-energy (TKE) distributions strongly deviated from the Gaussian shape characteristically found in the fission of all other actinides. When the TKE distributions are resolved into two Gaussian's, the constituent peaks lie near 200 and near 233 MeV. We conclude two modes or bimodal fission is occurring in five of the six nuclides studied. Both modes are possible in the same nuclide, but one generally predominates. We also conclude the low-energy but mass-symmetrical mode is likely to extend to far heavier nuclei; while the high-energy mode will be restricted to a smaller region, a region of nuclei defined by the proximity of the fragments to the strong neutron and proton shells in ^{132}Sn. 21 refs., 7 figs., 1 tab.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 13321, 13328, 13956, 13957

13899 **(DOE/FTR—9004990) [Collaborative discussions at Rome and Trieste Universities, Italy, Institute of Nuclear Physics, Krakow, Poland, and lecture at 23rd School on Physics, Zakopane, Poland, March 26--May 1, 1988]: Foreign trip report.** Hanson, A.L. (Brookhaven National Lab., Upton, NY (USA)). 11 May 1988. Contract AC02-76CH00016. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004990/JAW.

Travel to Rome was to work with Prof. G.E. Gigante to further a collaboration started with him during a six-month sabbatical stay at BNL. Prof. Gigante and I have been studying both theoretically and experimentally the effects of geometry on the spectra of the Compton-scattered x rays. Compton scattering is useful for normalization of x-ray fluorescence spectra and as a materials probe to determine changes in electronic structure. Since the energies of the scattered photons depend on the angle of scatter, geometrical effects are important, but usually neglected. Travel to Trieste was to present a seminar on using synchrotron radiation for x-ray fluorescence and to discuss the possibilities of setting up a dedicated x-ray fluorescence beam line at Synchrotron Trieste, Italy. The one-week visit to the Institute of Nuclear Physics, Krakow, was to work with Mr. W. Kwiatek on writing up work performed during his stay at BNL. The one-week stay in Zakopane, Poland, was to attend the XXIII Zakopane School on Physics and present an invited lecture entitled "Roles of Scattered Radiation in SRIXE."

13900 **(LA-UR—88-4050) Information content of lineshapes.** Silver, R.N.; Sivia, D.S.; Pynn, R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 12p. (CONF-8810182—9). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005454/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

We examine the question of figures-of-merit for optimizing the lineshapes of neutron scattering sources, instruments and experiments. Using maximum entropy deconvolution of simulated data, we test the effects of various features of lineshapes including intensity, resolution (FWHM), shape, and background. We demonstrate that conventional figures-of-merit are of limited validity, and we suggest that bandwidth is an important criterion for optimization. 9 refs., 7 figs.

13901 **(RAL—88-070) Lectures on neutron scattering techniques: 1. The production of neutrons.** Carlile, C.J. (Rutherford Appleton Lab., Chilton (UK)). Aug 1988. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756025/JAW.

The lecture on the production of neutrons was presented at a Summer School on neutron scattering, Rome, 1986. A description is given of the production of neutrons by natural radioactive sources, fission, and particle accelerator sources. Modern neutron sources with high intensities are discussed including the ISIS pulsed neutron source at the Rutherford Appleton Laboratory and the High Flux Reactor at the Institut Laue Langevin. (U.K.).

6550 Medical Physics

REFER ALSO TO CITATION(S) 13433

13902 **(INFO—0166-Rev.1) Determination of the radiological impact of radioisotope waste disposal.** (Atomic Energy Control Board, Ottawa, Ontario (Canada); Beak Consultants Ltd., Toronto, Ontario (Canada)). Sep 1986. 281p. NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS. Order Number DE88705109/JAW.

The Atomic Energy Control Board (AECB) controls the uses of radioisotopes and the management of wastes resulting from radioisotope use through licences. In most cases, wastes generated through the use of radioisotopes are required by licence condition to be sent to Chalk River Nuclear Laboratories for storage but if the amounts of radioisotope are very small, have a low activity or a very short half-life, the radioisotope is permitted to be released to regular waste management systems. The AECB commissioned this study to determine the doses to individuals working in municipal waste management systems and to populations of cities where small amounts of radioisotopes are disposed of through the municipal waste managment systems. The Hamilton-Burlington area surrounding Hamilton Harbour was selected as the study area. The pathways and dosimetry models were put into a computer spread sheet, to give the model flexibility so that it could be easily modified to model other cities. Within the occupational critical group, the maximum doses were calculated for the Hamilton sewage treatment plant aeration worker at 1.2E-6 Sv/a. If this individual were also a member of the critical group in the general population, the maximum dose would be 2.0E-6 Sv/a. Individual doses to the critical group within the general population were calculated as 7.7E-7 Sv/a for adults and 6.8E-8 Sv/a for infants. These compare to AECB regulatory limits of 5.0E-2 Sv/a per person for atomic radiation workers and 5.0E-3 Sv/a per person for the general public. The collective population dose for the study area was 1.37E-1 person-Sv/a or an average dose of 2.6E-7 Sv/a per person for the 525,000 population.

13903 **(INFO—0189) Neutron dosimetry for oil-well logging operations. An intercomparison of NTA and CR-39 dosimeters.** Cross, W.G.; Arneja, A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Apr 1986. 21p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705113/JAW.

Neutron doses recorded by NTA emulsion dosimeters and CR-39 damage track dosimeters, for a small, selected group of workers in the oil-well logging industry, have been compared over a one-year period. The same individuals wore NTA dosimeters for the normal one-month periods and CR-39 dosimeters for various periods from a month to a year. The results show that these workers often receive monthly dose equivalents between 30 μSv and the practical lower level of detectability (200 μSv) of the NTA dosimeters. However only 17% of the measured CR-39 dose equivalents totalled more than 1 mSv for the year, the maximum being 1.54 mSv. These dose equivalents are small compared with those received by many radiation workers in other industries.

13904 (INIS-SU—12, pp 113-116) **On the problem of organization of continuous monitoring of NPP liquid wastes.** Zhernov, V.S.; Zalmanzon, Yu.E.; Pushkin, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A07/MF A01; INIS. Order Number DE89780052/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2.

In Nuclear instrument making. Scientific-technical collection.

A possibility to reduce the lower boundary of the measurement range of volume activity of NPP liquid wastes when using the UDZhG-14R1 device produced in series with the D3-28 computer is considered. The results obtained give evidence about the fact monitoring of volume activity of 1.2x10/sup 3/ Bg/cm/sup 3/ liquid wastes is possible when using the UDZhG-141 device with the error - not more than 35% at confedence level - 0.95.

13905 **(PB—89-131890/XAB) Guide for preparing annual reports on radiation-safety testing of electronic products (general).** (Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health). Oct 1987. 13p. (FDA/CDRH—89/13). NTIS, PC A03/MF A01.

Supersedes PB—82-214206.

For manufacturers of electronic products other than those for which a specific guide has been issued, the guide replaces the Guide for the Filing of Annual Reports (21 CFR Subchapter J, Section 1002.11), HHS Publication FDA 82-8127. The electronic product (general) annual reporting guide is applicable to the following products: products intended to produce x radiation (accelerators, analytical devices, therapy x-ray machines); microwave diathermy machines; cold-cathode discharge tubes; and vacuum switches and tubes operating at or above 15,000 volts. To carry out its responsibilities under Public Law 90-602, the Food and Drug Administration's Center for Devices and Radiological Health

(CDRH) has issued a series of regulations contained in Title 21 of the Code of Federal Regulations (CFR). Part 1002 of 21 CFR deals with records and reports. Section 1002.61 categorizes electronic products into Groups A through C. Section 1002.30 requires manufacturers of products in Groups B and C to establish and maintain certain records, while Section 1002.11 requires such manufacturers to submit an Annual Report summarizing the contents of the required records. Section 1002.7 requires that reports conform to reporting guides issued by CDRH unless an acceptable justification for an alternate format is provided.

13906 **(PNL-SA—15930) US Department of Energy radiological calibration intercomparison program.** Cummings, F.M.; McDonald, J.C. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 7p. (CONF-881232—15). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005332/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

The US Department of Energy (DOE) radiological calibration intercomparison program was initiated in 1986 under the research phase of the DOE Laboratory Accreditation Program (DOELAP). The program operates by shipping instrument sets and secondary standard beta source sets to participating laboratories. The participants measure either exposure or dose rates with the instruments and then compare these values with the expected rates. This process tests not only the quality of the equipment but also the ability of the staff to correctly use and interpret the results obtained with the equipment. The results of this program provide documentation of the accuracy and uniformity of radiological calibrations in DOE laboratories. The measurements taken in fiscal year (FY) 1987 yielded the following results. The average ratio of expected to measured exposure rates for photon sources was 1.01. The average ratio of expected to measured absorbed dose rates was 1.04 for beta sources and 2.13 for neutron sources. Results from the first two years of operation (FY 1986 and FY 1987) are presented in order to show the improvement observed in these intercomparison measurements. The plans for future program enhancements will also be discussed. 4 refs.

6560 Condensed Matter Physics

REFER ALSO TO CITATION(S) 13112, 13114, 13119, 13121, 13138, 13175, 13237, 13749, 13750, 13754, 13755, 13778, 13960, 14031

13907 **(AD-A—199728/7/XAB) Fragmentation of molecular adsorbates by electron and ion bombardment: methoxy chemistry on Al(111).** Basu, P.; Chen, J.G.; Ng, L.; Colaianni, M.L.; Yates, J.T. (Pittsburgh Univ., PA (USA). Surface Science Center). 15 Aug 1988. 7p. NTIS, PC A02/MF A01.

Pub. in Jnl. of Chemical Physics, Vol. 89, No. 4, 2406-2411(15 Aug 1988).

High-resolution electron-energy-loss spectroscopy (HR)EELS has been used successfully to provide direct spectroscopic evidence regarding details of the molecular fragmentation of methoxy (CH_3O) on Al(lll) caused by energetic electron and ion beams. Chemisorbed methoxy on Al(lll) is produced by heating of absorbed CH_3OH. Irradiation of CH_3O(a) by either energetic (approx 300 eV) electrons or Ar+ ions results in C-O and C-H bond scission with simultaneous formation of Al-O and Al-C bonds. During electron stimulated desorption the CH_3O(a) species undergo sequential fragmentation first to CHx groups that are captured by the surface and in the final decay process to adsorbed carbon. C-O bonds in CH_3O_9a) are depleted preferentially compared to C-H bonds in CHx(a) species. The electron-induced sequential fragmentation of the patent CH_3 group (from methoxy) to resultant CHx(a) occurs with an efficiency approx. 3 orders of magnitude greater than the subsequent process of CHx(a)=C(a). Cross sections for various bond scission processes in electron and ion bombardment have been estimated.

13908 **(AD-A—199729/5/XAB) Electron-stimulated desorption from CO chemisorbed on pt(111): a dynamical study of positive ion and metastable CO emission.** Kiskinova, M.; Szabo, A.; Lanzillotto, A.; Yates, J.T. (Pittsburgh Univ., PA (USA). Surface Science Center). 1988. 6p. NTIS, PC A02/MF A01.

Pub. in Jnl. of Surface Science, Vol. 202 L559-L567(1988).

The desorption by electron impact of significant quantities of electronically excited neutral species, CO^{+1}, from CO absorbed on Pt(111) has been discovered. Comparison of the yield of this species as a function of electron energy, coverage, and temperature, with the yield of O^{+1} and CO^{+1} has led to the conclusion that the CO species is mainly produced by direct excitation. Studies of the angular distribution of the three ESD-derived species have been made as a function of temperature, and high amplitude bending vibrational modes are observed. Isotope effects in the three desorption channels were measured.

13909 **(BNL—41275) Measurement of passive film growth kinetics on bare surface band microelectrodes.** Davenport, A.J.; Isaacs, H.S. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 6p. (CONF-881061—12). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004516/JAW.

From Electrochemical Society fall meeting; Chicago, IL, USA (9 Oct 1988).

A new method has been developed for the study of bare surface electrochemistry at shorter times and higher current densities than those conventionally achieved. This technique involves in situ fracture of a sputtered metal film between two glass slides to create a band microelectrode. This has the advantage over electrodes of conventional size of an increase in the rate of mass transport to and from the surface and reduction in the ohmic (IR) drop. The bare microelectrode method has been used to study the repassivation kinetics of sputtered niobium films. 9 refs., 5 figs.

13910 **(BNL—41957) Electron microscopy and neutron scattering studies of premartensitic behavior in ordered Ni-Al βZ phase.** Schryvers, D.; Tanner, L.E.; Shapiro, S.M. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016;W-7405-ENG-48. 8p. (CONF-880529—8). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005645/JAW.

From MRS international meeting on advanced materials; Tokyo, Japan (30 May 1988).

High-resolution electron microscopy and elastic and inelastic neutron scattering examinations of the β_2 (B2) phase of Ni/sub 62. 5/Al/sub 37.5/ show a direct relationship between the evolution of premartensitic structural configurations and anamalous changes in lattice dynamical behavior as the β_2 cools toward its martensitic transformation temperature, M/sub s/. The resulting microstructure is a fine-scale mosaic assembly of nonuniformly distorted and modulated domains, in which {l←brace}110{r←brace}<110> shear-plus-shuffle displacements five rise to the {l←brace}110{r←brace}B2 micromodulations of {approximately}1.3 nm wavelength. These displacements are derived from the unusually low energy of the Σ_4<{zeta}{zeta}O> {minus} TA_2 phonon mode and its anomalous temperature-dependent incomplete softening at {zeta} = O (viz., the elastic constant C') and at {zeta} ~ 0.16. The domains ("dressed embryos" in Yamada's terminology) are viewed as the precursors to nucleation of the product 7R(52) martensite; the way this transformation process is facilitated, however, is still a problem to be solved. 36 refs., 6 figs.

13911 **(BNL—42053) A study of Pd-Ta on Si(100) using AES, RBS and variable energy positron annihilation.** Van Der Kolk, G.J.; Kuiper, A.E.T.; Duchateau, J.P.W.B.; Willemsen, M.; Nielsen, B.; Lynn, K.G. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 21p. (CONF-881002—42). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005646/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

The applicability of Pd/sub x/Ta/sub 1-x/ as a diffusion barrier on Si has been investigated. For this purpose Pd/sub x/Ta/sub 1-x/ films of 200 nm thickness (x ranges from 0 to 1) were deposit-

ed on Si(100), and the reaction between over-layer and substrate was studied as a function of temperature. Interaction was found to occur at temperatures increasing with the Ta content. The as-deposited Pd/sub x/Ta/sub 1-x/ films with $0.2 \leqq x \leqq 0.6$ were found to be amorphous. The amorphous phase had a higher reaction temperature than the crystalline one, causing a discontinuous step in the reaction temperature. RBS spectra revealed that for the Pd-rich compositions first a stoichiometric Pd_2Si layer formed underneath a pure Ta layer. At higher temperatures $TaSi_2$ formed at the surface. For Ta-rich compositions Pd_2Si formed first as well, however, the reaction temperature was so high that Pd_2Si grains formed in a Si matrix. The defect density of the Ta layer, which remained after outdiffusion of Pd, was investigated using variable energy positron annihilation. The defect concentration is very high, as deduced from the trapped positron fraction. A model is presented that describes the composition dependence of the reaction temperature. 26 refs., 6 figs., 1 tab.

13912 **(CONF-880272—3) Electronic structure calculation by nonlinear optimization: Application to metals.** Benedek, R.; Min, B.I.; Woodward, C.; Garner, J. (Argonne National Lab., IL (USA)). Apr 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005852/JAW.

From Computer simulation studies in condensed matter physics: recent developments; Athens, GA, USA (23 Feb 1988).

There is considerable interest in the development of novel algorithms for the calculation of electronic structure (e.g., at the level of the local-density approximation of density-functional theory.) In this paper we consider a first-order equation-of-motion method. Two methods of solution are described, on proposed by Williams and Soler, and the other base on a Born-Dyson series expansion. The extension of the approach to metallic systems is outlined and preliminary numerical calculations for Zintl-phase NaTl are presented. 17 refs., 2 figs.

13913 **(CONF-880623—3) Molten Ag_2Se: A molecular dynamics study.** Hornos, Y.M.M.; Antonio, G.A.; Rino, J.P.; Ebbsjo, I.; Kalia, R.K.; Vashishta, P. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003984/JAW.

From 11. symposium on the reactivity of solids; Princeton, NJ, USA (19 Jun 1988).

We report a molecular dynamics (MD) study of molten Ag_2Se. An effective pair potential, including the steric repulsion, Coulomb and charge-dipole interaction is used. Among structural and dynamical properties we have calculated partial pair-correlation functions, partial structure factors, velocity autocorrelation functions and self diffusion constants for Se and Ag ions. Comparison of calculated structure factor and neutron diffraction experiment shows good agreement. 10 refs., 6 figs.

13914 **(CONF-880623—4) A molecular dynamics study of $SiSe_2$ glass.** Antonio, G.A.; Kalia, R.K.; Vashishta, P. (Argonne National Lab., IL (USA)). Oct 1988. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004267/JAW.

From 11. symposium on the reactivity of solids; Princeton, NJ, USA (19 Jun 1988).

We report the results of a molecular dynamics study of molten and glassy $SiSe_2$ using an effective interparticle interaction. Results for the partial pair-correlation functions, partial structure factors, bond-angle distributions and statistics of rings are reported. Results are in good agreement with the neutron diffraction experiments. 11 refs., 6 figs.

13915 **(CONF-880623—7) Density-functional theory of three-body interactions in liquids and glasses.** Iyetomi, H.; Vashishta, P. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005859/JAW.

From 11. symposium on the reactivity of solids; Princeton, NJ, USA (19 Jun 1988).

The integral equation for the correlation functions of liquids and glasses is derived in the presence of a weak three-body potential. The inclusion of three-body forces is essential to describe the covalent interactions. The formulation is based on a generalization of the density-focused theory in which the free energy is regarded as a functional not only of the density but also of the two-body distribution function. In the first-order calculation, the structure of the two-body theory is not modified by virtue of the variational property; the three-body effects are fully taken into account through renormalization of the pair potential. An approximate expression for the three-body correction which is amenable to the numerical computations is obtained. 14 refs.

13916 **(CONF-8806145—3) Temperature dependence of ion-beam mixing in Fe/Zr bilayers.** Ding, Fu-Rong; Okamoto, P.R.; Rehn, L.E. (Argonne National Lab., IL (USA)). May 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005872/JAW.

From 6. international conferene on ion beam modification of materials; Tokyo, Japan (12 Jun 1988).

Ion-beam mixing results obtained as a function of temperature during 1 MeV Kr irradiation of Fe/Zr bilayer films prepared by vapor deposition onto oxidized Si substrates are reported. RBS measurements of W marker shifts showed that Fe atoms diffuse faster than Zr atoms do during irradiation. X-ray diffraction using a Read camera indicated the formation of an amorphous phase during mixing. Activation enthalpies of 1.4 eV for mass transport at temperatures above 480 K, and 0.07 eV at temperatures between 330–470 K, were extracted from the measurements. A comparison of the mixing of Fe/Zr with that in Au/Zr and Ni/Zr bilayers reported previously shows that Fe atoms in Fe/Zr bilayers mix much more slowly than Au atoms in Au/Zr and Ni atoms in Ni/Zr. Mixing differences in both temperature intervals correlate well with calculated heats of mixing in the various bilayers, but show essentially no correlation with existing thermal diffusion data. 13 refs., 4 figs.

13917 **(CONF-8808136—3) Medium-range order and phonon density of states of a-$GeSe_2$.** Vashishta, P.; Kalia, R.K.; Antonio, G.A.; Ebbsjoe, I. (Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005830/JAW.

From Condensed matter theories; Taxco, Mexico (14 Aug 1988).

In recent years there have been careful experimental studies of the structure and vibrational spectra of a-$GeSe_2$. These studies have focused on mainly two issues: The origin of the first sharp diffraction peak (FSDP) and its anomalous temperature variation. The origin of the companion line A/sub 1c/ of the symmetric breathing modes A_1. In this paper we examine these two issues with molecular dynamics simulations using an effective interatomic interaction. 31 refs., 5 figs.

13918 **(CONF-8808141—8) Liquid gallium cooling of silicon crystals in high intensity photon beam.** Smither, R.K.; Forster, G.A.; Bilderback, D.H.; Bedzyk, M.; Finkelstein, K.; Henderson, C.; White, J.; Berman, L.E.; Stefan, P.; Oversluizen, T. (Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38. 40p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005875/JAW.

From 3. international conference on synchrotron radiation instrumentation; Tokyo, Japan (29 Aug 1988).

The high-brilliance, insertion-device-based, photon beams of the next generation of synchrotron sources will deliver large thermal loads (1 kW to 10 kW) to the first optical elements. Considering the problems that present synchrotron users are experiencing with beams from recently installed insertion devices, new and improved methods of cooling these first optical elements, particularly when they are diffraction crystals, are clearly needed. A series of finite element calculations were performed to test the efficiency of new cooling geometries and new cooling fluids. The best results were obtained with liquid Ga metal flowing in channels just below the surface of the crystal. Ga was selected because of its good thermal conductivity and thermal capacity, low melting point, high boiling point, low kinetic viscosity, and very low vapor pressure. Its very low vapor pressure, even at elevated temperatures, makes

it especially attractive in uhv conditions. A series of experiments were conducted at CHESS in February of 1988 that compared liquid gallium cooled silicon diffraction crystals with water cooled crystals. 2 refs., 16 figs., 1 tab.

13919 **(CONF-8808141—9) Measuring the momentum distribution of the unpaired spin electrons in ferromagnets using synchrotron radiation.** Mills, D.M. (Argonne National Lab., IL (USA)). Dec 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005864/JAW.

From 3. international conference on synchrotron radiation instrumentation; Tokyo, Japan (29 Aug 1988).

The dominant term in the x-ray Compton cross-section of an electron is the interaction of the photon and the electron's charge. Platzman and Tsoar many years ago pointed out that there is also an interaction between an x-ray and the electron's spin and in principle this interaction can give information on the momentum distribution of the unpaired spin electrons in the solid. Unfortunately, the spin sensitive term is not only small compared to the charge term, but in addition couples to the photons in first order only with that components of the x-ray beam that is circularly polarized. A lack of intense sources of circularly polarized x-rays combined with the relative small size of the spin sensitive term makes measurements of the momentum distributions of unpaired spin electrons difficult, resulting in little experiment progress initially made in spin or magnetic Compton scattering. In the past several years, interest in spin sensitive Compton scattering has been revived due in large part to the availability of intense beams of high energy photons from synchrotron radiation sources. The radiation from storage ring sources has well defined polarization states; highly linearly polarized in the orbital plane and elliptically polarized above and below the plane of the orbit of the circulating particles. The high flux and unique polarization properties of synchrotron radiation sources have greatly facilitated measurements of the momentum distributions of the unpaired spin electrons in ferromagnetic solids. Recent results of the work of several groups will be presented, along with some thoughts on the impact that the next generation of storage rings, such as the Advanced Photon Source, and insertion devices specifically designed to produce circularly polarized x-ray beams will have on the field of magnetic Compton scattering. 21 refs., 6 figs.

13920 **(CONF-8808141—10) Variable focus crystal diffraction lens.** Smither, R.K. (Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38. 23p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005885/JAW.

From 3. international conference on synchrotron radiation instrumentation; Tokyo, Japan (29 Aug 1988).

A new method has been developed to control the shape of the surface of a diffracting crystal that will allow it to function as a variable focus crystal diffraction lens, for focusing photon beams from a synchrotron source. The new method uses thermal gradients in the crystal to control the shape of the surface of the crystal in two dimensions and allows one to generate both spherical and ellipsoidal surface shapes. In this work the thermal gradient was generated by core drilling two sets of cooling channels in a silicon crystal so that cooling or heating fluids could be circulated through the crystal at two different levels. The first set of channels is close to the surface of the crystal where the photon beam strikes it. The second set of channels is equal distant from the back surface. If a concave surface is desired, the fluid in the channels just below the surface exposed to the beam is cooler than the fluid circulating through the channels near the back surface. If a convex surface is desired, then the cooling fluid in the upper channels near the surface exposed to the incident photon beam, is warmer than the fluid in the lower channels. The focal length of the crystal lens is varied by varying the thermal gradient in the crystal. This approach can also be applied to the first crystal in a high power synchrotron beam line to eliminate the bowing and other thermal distortions of the crystal caused by the high heat load. 6 refs., 8 figs., 3 tabs.

13921 **(CONF-8809134—4) Collision cascades and sputtering induced by larger cluster ions.** Sigmund, P. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005857/JAW.

From 2. international workshop on MeV and KeV ion and cluster interactions with surfaces and materials; Orsay, France (5 Sep 1988).

Recent experimental work on larger cluster impact on solid surfaces suggests large deviations from the standard case of additive sputter yields both in the nuclear and electronic stopping regime. The paper concentrates on elastic collision cascades. In addition to very pronounced spike effects, two phenomena are pointed out that are specific to cluster bombardment. Multiple hits of cluster atoms on one and the same target atom may result in recoil atoms that move faster than the maximum recoil speed for monomer bombardment at the same projectile speed. This effect is important when the atomic mass of a beam atom is less than that of a target atom, $M_1 << M_2$. In the opposite case, $M_1 >> M_2$, collisions between beam particles may accelerate some beam particles and slow down others. Some consequences are mentioned. Remarks on the nuclear stopping power of larger clusters and on electronic sputtering by cluster bombardment conclude the paper. 38 refs., 2 figs.

13922 **(DOE/ER/01198—2481) Studies of diffusion by diffraction/scattering techniques.** Chen, H. (Illinois Univ., Urbana (USA). Dept. of Materials Science and Engineering). 1988. Contract AC02-76ER01198. 34p. (CONF-8809226—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003850/JAW.

From Diffusion analysis and applications symposium; Chicago, IL, USA (28 Sep 1988).

Novel elastic diffraction/scattering methods utilizing x-rays of thermal neutrons are now available for studying the kinetic process of a phase transformation, a solid state reaction, and atomic diffusion in an in-situ manner. In particular, diffusion models governing the transformation and/or reaction can be tested on a microscopic scale yielding detailed information on interdiffusion coefficients, diffusion paths, relaxation times, and other rate controlling parameters. Determination of these parameters entails using a particular diffusion model to interpret the kinetic parameter(s) that can be extracted from the diffraction/scattering data. This can be accomplished by either direct (real) space or reciprocal space approaches. In this paper the scattering theories as well as experimental details of both wide-angle and small-angle diffraction/scattering methods are discussed. Several examples are illustrated to demonstrate the practicality of the techniques. 31 refs., 25 figs., 1 tab.

13923 **(DOE/ER/13482—2) [Transport properties of disordered porous media from the microstructure]: Progress report, 1 March 1986--28 February 1988.** Torquato, S. (North Carolina State Univ., Raleigh (USA)). 1988. Contract FG05-86ER13482. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005953/JAW.

Progress has been made in four general areas: the derivation of new bounds for effective properties of disordered media which depend upon the microstructure through various sets of correlation functions, the development of a unified methodology to represent and calculate these correlation functions for nontrivial models of heterogeneous media, the calculation of existing and new bounds on effective parameters which depend upon this microstructural information, and the study of percolation in continuum models (e.g., media in which one phase is composed of a distribution of particles). Progress made in areas 2 and 4 is together summarized in subsection B under the general heading of microstructure characterization. Progress made in areas 1 and 3 is summarized in subsections C-F for each effective property, i.e., conductivity, permeability, rate constant, and elastic moduli. It should be mentioned that our calculations of effective properties compared very favorably with available experimental data.

13924 **(DOE/ER/45084—1) Two dimensional colloidal systems: Final report, May 1, 1984--July 31, 1987.** Meyer, R.B. (Brandeis Univ., Waltham, MA (USA)). Dec 1988. Contract FG02-84ER45084. 36p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005747/JAW.

Studies have been made of two dimensional colloidal systems consisting of sub-micron sized polystyrene spheres trapped between two parallel glass surfaces a few microns apart. We varied the spacing between the surfaces and the density of particles. Because the particles are electrostatically charged, they repel one another, leading to a variety of ordered structures. We studied two dimensional melting, electric field induced aggregation, and short range attractive interactions between the particles. The melting phenomenon exhibits precursor effects, but we saw no definitive evidence of two stage melting or a hexatic phase. The field induced aggregation leads to strings of particles oriented parallel to the field, at low density, and to raft formation at high density. Our study is the first complete experimental test of theories of the string formation process. We measured the pair correlation function in dilute two dimensional systems to test for attractive interactions between particles. Preliminary results show an unexplained short range attraction between particles, that is of a different functional form than the van der Waals force. To carry out these studies, we developed a powerful image analysis system, and specialized sample cells. 11 refs., 11 figs.

13925 **(DOE/ER/45253—3) Fundamental optical studies of competitive adsorption and thin film phenomena: Progress report, July 1, 1986--December 31, 1988.** Furtak, T.E. (Colorado School of Mines, Golden (USA). Dept. of Physics). Dec 1988. Contract FG02-86ER45253. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005898/JAW.

We have concentrated on understanding the mechanisms of unusual surface optical phenomena that show potential of development as tools for study of the electrolyte-solid interface. Our work has revealed the origin of the chemical component of surface enhanced Raman scattering (SERS). This was found to be concentrated at small Ag clusters, upon which special adsorption can take place and within which electronic resonance operates to increase the Raman cross section. Optical second harmonic generation (SHG) was studied with regard to its ability to determine the symmetry of adsorbed metal monolayers. Success was achieved in the cases of Cd, Tl, and Zn on Ag(111). Each example is unique, demonstrating a range of phenomena and showing how SHG can be used as an interfacial probe. Initiatives were generated in scanning tunneling microscopy and reflectance spectroscopy. Together these techniques have given us a powerful capability to examine the microscopic details of the electrolyte-solid interface.

13926 **(DOE/ER/45291—2) Optical studies of dynamical processes in disordered systems: Progress report for 1988.** Yen, W.M. (Georgia Univ., Athens (USA). Dept. of Physics and Astronomy). Sep 1988. Contract FG09-87ER45291. 25p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005558/JAW.

We summarize the progress we have achieved in several areas central to the mission of this grant. These include advanced in our understanding of the nature of relaxation processes which affect the optical linewidths and in the analysis of optical energy transfer accompanied by spectral diffusion in inorganic glasses. We have also developed and demonstrated two new laser spectroscopic techniques, Saturation Resolved Fluorescence (SRF) and Dilution Narrowed Spectroscopy (DNS), which have contributed to our understanding of transparent activated ceramics and other areas of interest. We continue by discussing additional work we propose to undertake, inclusive of on-going activity and certain interesting new initiatives. The bulk of the proposed work is, naturally, based on the experimental accomplishments of the present effort; while the new initiatives center on the opportunities new techniques, such as SRF and DNS, have opened up and on the availability of new optical materials, often with restricted dimensions. 39 refs., 7 figs.

13927 **(DOE/FTR—9005082) [Visit to the Physical Chemistry Department of the Center of Nuclear Studies, Saclay, France, and Workshop on the investigation of energetic ion bombardment of surfaces, Orsay, August 23--September 19, 1988]: Foreign trip report.** Beuhler, R. (Brookhaven National Lab., Upton, NY (USA)). 26 Sep 1988. Contract AC02-76CH00016. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005082/JAW.

This paper describes a foreign trip made by Robert Beuhler. Some topics discussed are: nozzle beam isotope separation; generation of 3rd harmonics of XUV radiation in a free jet of carbon monoxide; photodissociation of NO_2; investigation of energetic ion bombardment of surfaces; interaction of hydrogen clusters with gases, foils and solid targets; and large cluster impacts on surfaces. (LSP)

13928 **(FRCEA-TH—157) Study of neutron diffraction profiles in time of flight using a statistical chipper. Application to the study of tetrahedral and perovskite type nitric oxide structures.** Bacher, P. (Grenoble-1 Univ., 38 (France); CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). May 1987. 188p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88756674/JAW.

It is shown that the slight asymmetry observed in the profile of neutron diffraction rays in time of flight using a statistical chopper is due to the focusing control of the detectors. Composition heterogeneity in solid solutions and the resulting ray profiles was studied, using a model of linear diffusion of atoms between two kernels. The structure of oxynitric phases was also studied: terahedral structures coming from that of wurtzite; and perovskite type structures. Results show a partial oxygen-nitrogen order in Lil.33Gel.67ON2; a potassium-nitrogen bond in KGeON; and fluctuations of composition in Znl.231Ge0.689O0.782Nl.218. Study of the composites BaTa02N, BaNb02N, SrTa02N, and LaWO0.6N2.4 shows the influence of the ray of the atom of coordination 12 (Ba, Sr, or La) on lattice symmetry.

13929 **(IC—88/199) Generalized Gutzwiller Ansatz for the half-filled Hubbard chain.** Fazekas, P.; Penc, K. (International Centre for Theoretical Physics, Trieste (Italy); Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 15p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705346/JAW.

The well-known Gutzwiller wave function is generalized by including new variational parameters to control nearest-neighbour charge-charge, charge-spin, and spin-spin correlations. The nonmagnetic state of one-dimensional, half-filled Hubbard model is studied. Within the Gutzwiller approximation, the expression for the ground state energy can be worked out analytically. The correlation between empty and doubly occupied sites is found to play the most essential role. Minimization in the large-U limit shows that the Brinkman-Rice transition has been pushed to U -> ∞, and the leading term of the ground state energy density is of order -t/sup 2//U. In contrast to results obtained with the Gutzwiller wave function, we find that the band occupation number n/sub k/ is monotonically decreasing both above and below k/sub F/. The dominant k-dependence is given by ~ (t/U)cos k, in agreement with t/U-expansion results. n/sub k/ has also a weak step-function component, with the discontinuity at k/sub F/ vanishing as (t/U)/ sup 2/ in the limit U/t>>1. (author). 27 refs, 1 fig.

13930 **(IC—88/204) Resonance tunnelling and breakdown of the Quantum Hall Effect in strong electric fields.** Pokrovsky, V.L.; Pryadko, L.P.; Talapov, A.L. (International Centre for Theoretical Physics, Trieste (Italy); AN SSSR, Moscow. Inst. Teoreticheskoj Fiziki). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 21p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705348/JAW.

Resonance scattering of electrons on impurities is shown to play a crucial role in nonlinear conductivity under QHE conditions at zero temperature. The dissipative current as a function of an

electric field and Landau level filling factor is calculated. (author). 16 refs.

13931 **(IC—88/247) Theory of Raman scattering by surface polaritons in a four media system.** Nkoma, J.S. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 27p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705358/JAW.

The method of linear response theory is used to determine the response functions for surface polaritons in a four media system (or bounded bilayer). The dispersion relation is found when the pole of the derived response function vanishes. The expressions for the scattered intensity for both back and forward scattering are derived. The scattered intensity depends on a polarization which is the result of the coupling of the incident light to the vibrational coordinates and electric fields associated with electric-dipole-active lattice vibrations in the bilayer. Expressions for the Raman cross-section by surface polaritons in the four media system are derived for both back and forward scattering. Numerical results are presented by using parameters for a sapphire substrate-(GaP-GaAs) bilayer-vacuum system. (author). 28 refs, 5 figs.

13932 **(IC—88/255) Evaluation of the Kubo formula for the conductivity using the recursion method.** Yeyati, A.L.; Weissmann, M.; Anda, E. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Dept. de Fisica). (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 24p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705359/JAW.

We propose a numerical algorithm based on the recursion method to calculate the conductivity of a disordered system described by a tight-binding Hamiltonian. It has the advantage that the density of states and the conductivity can be obtained in a single recursion calculation. The method is applied to simple one and two-dimensional incommensurate systems in order to check the validity of the assumptions made and the numerical efficiency. The calculated conductivity shows a clear drop when the Fermi energy crosses a mobility edge. Potential applications of this work to other systems are discussed. (author). 13 refs, 9 figs.

13933 **(IC—88/290) Surface and interface local density of states for Nb, V and Ta.** Baquero, R.; Camacho, A.; Quiroga, L. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 18p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705365/JAW.

We have calculated the local density of states at the surface and in the interface for the transition metals Nb, V and Ta using empirical tight-binding Hamiltonians and the formulae of the Surface Green Function Matching (SFGM) method. We get the local density of states at the surface and at the inner atomic layers. The effect of the surface is strong and very localized. We notice that certain characteristics of the Surface Local Density of States (SLDOS) correlate well with the known magnetic and superconducting properties of each metal. At the interface the LDOS resembles much more the bulk one than at the surface but the effect is less localized. We do not take into account strain and assume an ideal interface but we do take into account charge neutrality in the interface and at the surface using the Friedel sum rule in a standard way. (author). 10 refs, 5 figs.

13934 **(IC—88/298) Influence of shallow trapped state on positron specific trapping rate in small-size vacancy clusters.** Shen, J.Q.; Lung, C.W. (University of Science and Technology of China, Hefei (China). Centre for Fundamental Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 10p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705366/JAW.

The positron specific trapping rate from free state to first excited state in a small size vacancy cluster trap is calculated. The influence of the shallow trapped state on the process of positron trapping in the vacancy clusters is discussed. It seems that the presence of a shallow state makes the process strongly temperature dependent, especially at low temperatures. Some recent experiments are explained with this effect. (author). 14 refs, 3 figs.

13935 **(IC—88/305) Nonlinear dynamical phenomena in liquid crystals.** Wang, X.Y.; Sun, Z.M. (International Centre for Theoretical Physics, Trieste (Italy); Nanjing Univ. (China). Inst. of Solid State Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 26p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705367/JAW.

Because of the existence of the orientational order and anisotropy in liquid crystals, strong nonlinear phenomena and singular behaviors, such as solitary wave, transient periodic structure, chaos, fractal and viscous fingering, can be excited by a very small disturbance. These phenomena and behaviors are in connection with physics, biology and mathematics. 12 refs, 6 figs.

13936 **(IC—88/317) Finite size effects in Wigner crystallization of electrons on liquid helium layers.** Sunjic, M.; Lenac, Z. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 13p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705370/JAW.

Phase diagrams for the formation of a two-dimensional Wigner lattice of electrons on thin liquid helium layers deposited on metallic substrates are calculated, taking into account finite electron size normal to the surface and the substrate screening. Finite size effects soften the direct electron repulsion, but also weaken the screening effects, so that the total interaction is actually stronger than in the point electron approximation. Both the high density and the low density (classical) regimes are affected, and in particular the solid phase is shifted to lower densities, in agreement with the experiment. In this system it also becomes possible to study the gradual transition from classical to quantum regimes. (author). 16 refs, 5 figs.

13937 (JINR—D-14-87-799, pp 119-124) **Positive muons in Bi. Determination of sites and associated local lattice relaxation.** Barth, S.; Gygax, F.N.; Hitti, B.; Lippelt, E.; Schenck, A. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

A short summary of results on μ/sup +/ sites in Bi and associated local lattice relaxation is presented. The observed angular dependence of M/sub 2/ (M/sub 2/ - the second moment of field distribution) at 8 K and 100 K allowed to determine the most likely site of μ/sup +/ in Bi and implied a severe lattice contraction around a hydrogen-like impurity. The observed electric field gradients (EFG) are all radially directed away from the μ/sup +/ and assume extraordinarily large values (26 A/sup -3/). A conclusion is made that the present large EFG's must be correlated with the strong lattice distortion induced by the μ/sup +/. The reduced but temperature independent relaxation rate between 20 K and 60 K is discussed. 7 refs.; 5 figs.

13938 (JINR—D-14-87-799, pp 165-174) **Muonium states in semiconductors.** Patterson, B.D. (Zurich Univ. (Switzerland). Inst. fuer Physik). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

There is a brief summary of what is known about the muonium states isotropic, anisotropic and diamagnetic in diamond and zincblende semiconductors. The report deals with muonium spectroscopy, including the formation probabilities, hyperfine parameters and electronic g-factors of the states. The dynamics of the states is treated including a discussion of the transition from isotropic Mu to anisotropic Mu in diamond, temperature-dependent linewidthes in silicon and germanium and effects of daping and radiation damage. 25 refs.; 5 figs.; 2 tabs.

13939 (JINR—D-14-87-799, pp 14-22) **Newlest trends in the MSR - method.** Kruglov, S.P. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Attention to new trend in MSR-method development is paid in the report. Its development in the nearest years is predicted to a certain degree. An idea of applying MSR with level interaction (MLCR) for studying the properties of semiconductors, chemical compounds, magnetic materials and superconductors is demonstrated. Systems with heavy fermions and spin dynamics in amorphous magnetics and spin glasses are investigated. M/sup -/SR-experiments on measuring the hyperfine magnetic fields on muon in iron and MSR-experiments in quantum crystals and cryoliquids are described. 8 refs.; 6 figs.; 1 tab.

13940 (JINR—D-14-87-799, pp 54-62) **μSR study of spin glass and amorphous magnetics.** Ginzburg, S.L. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The present report is devoted to presenting experimental data and theoretical concept related to modern physics of spin glasses and amorphous magnetics and to the place of MSR method in the study of these phenomena. Currently it is completely obvious that the base of spin glass physics in the experiment is made by such properties as the state of non-equilibrium, phenomena of long-term logarithmic relaxation, aging, memory etc. From the theoretical viewpoint these phenomena are connected with a very nontrivial non-ergodicity form which is expressed in the existence of infinite number of energy minima (valleys), their space being of ierarchy character (space with ultrametric topology). 6 refs.; 6 figs.

13941 (JINR—D-14-87-799, pp 71-78) **Muon spin relaxation in isotropic ferromagnets in the vicinity of critical paramagnetic T/sub c/.** Yushankhaj, V.Yu.; Lazuta, A.V. (Joint Inst. for Nuclear Research, Dubna (USSR); AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

A theoretical description of muon spin relaxation in cubic ferromagnetics (FM) in the paramagnetic T/sub c/ vicinity is given. General expressions for transverse and longitudinal λ relaxation rates as the reduced temperature tau and magnetic field H functions are derived. On this base temperature dependences λ in Fe and Ni are discussed. Peculiarities of temperature behaviour Δ ω/sub μ/ near T/sub c/ (Δω/sub μ/-muon precession frequency shift) are considered. Comparison of muon data to the results obtained in Fe and Ni using disturbed angular correlation method is conducted. λ/sub parallel/ dependence on H field is theoretically investigated and possibility of experimental study of spin diffusion phenomenon near T/sub c/ is indicated. 19 refs.

13942 (JINR—D-14-87-799, pp 79-82) **Temperature dependence of residual polarization of positive muons in V/sub 2/O/sub 3/.** Balandin, M.P.; Dem'yanov, A.V.; Evseev, V.S. and others. 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Preliminary results of investigations into positive muon residual polarization dependence on the temperature in V/sub 2/O/sub 3/ are presented. The experiment is performed in a positive muon beam with 160 MeV/c momentum. Muon residual polarization was determined by muon spin precession amplitude in the external magnetic field. It is shown that at temperatures exceeding phase transition (162 K) the positive muon residual polarization in V/sub 2/O/sub 3/ is close to maximum possible and does not depend on the temperature. The center of paramagnetic-antiferromagnetic transition curve is present at 150 K and of antiferromagnetic one - at 162 K. 11 refs.; 1 fig.

13943 (JINR—D-14-87-799, pp 83-91) **Muon study of the domain structure of ferromagnets.** Kruglov, S.P.; Kuz'min, L.A.; Miloserdin, V.Yu.; Gorelkin, V.N.; Smilga, V.P. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki; Moskovskij Inzhenerno-Fizicheskij Inst. (USSR); Moskovskij Fiziko-Tekhnicheskij Inst. (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Experiments on studying the domain structure of ferromagnetics on the muon beam with targets of iron, anisotropic and isotropic steel-base alloys, are conducted. It is shown that the muon method in the zero external field can be applied for measuring domain structure and the other magnetic properties of ferromagnetics. Experimental accuracy in these measurements can be sufficiently high which allows one to study the effect of different factors (compression, annealing, coating) on the mutual magnetic properties. 7 refs.; 6 figs.

13944 (JINR—D-14-87-799, pp 92-95) **Muon defectoscopy of ferromagnetic metals.** Karpov, S.B.; Kolesnikov, A.S.; Miloserdin, V.Yu.; Mishchenko, A.Yu. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Experimental possibilities of applying muons in ferromagnetic metals are considered. It is shown, that application of positive muons allows one to measure concentration of defects, perform their diagnostics without destroying the sample and to investigate the defect effect on the muon oscillation level shift. It is underlined that by its sensitivity to measuring defect concentration and to defect type diagnostics the MSR method exceeds all the known methods. 2 refs.

13945 (JINR—D-14-87-799, pp 96-100) **Prospects of chemical diagnostics of microimpurities in the inertial matrix by muon and positron methods.** Sukhanovskaya, A.I.; Firsov, V.G. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Khimicheskikh Reaktivov i Osobo Chistykh Veshchestv, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

One of the aspects of applying Mu and Ps, namely, studying their interaction with impurity atoms in a chemically inert matrix of a solid body is considered. The final goal is to determine the microimpurity content in technologically important materials. This problem is especially pressing for anlytical chemistry of hyperpure matters. The applied methods of element-by-element determination of microimpurity content are labour consuming and often do not meet requirements of approximate nonselective analysis by "pure-impure" criterion at the level of total impurity content of 10/sup -3/-10/sup -5/% mass. 9 refs.; 1 fig.

13946 (JINR—D-14-87-799, pp 101-105) **μSR investigations of the high temperature superconductors La/sub 1.85/Sr/sub 0.15/CuO/sub 4/ and YBa/sub 2/Cu/sub 3/O/sub 7-δ/.** Birrer, P.; Gygax, F.N.; Hitti, B. and others. 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

μSR studies of La/sub 1.85/Sr/sub 0.15/CuO/sub 4/ and YBa/sub 2/Cu/sub 3/O/sub 7-δ/ high temperature superconductors are carried out. The interval magnetic properties of these systems are studied on a microscopic level in the 4 kOe magnetic field and in the temperature range 10 K - 120 K. The magnetic penetra-

tion depth λ in this system did not show any significant differences from the two temperature scans (10 K and 120 K) and it destroys a field independence above 1 kOe. For T=OK the authers obtain λ(OK)≅2650 A. 12 refs.; 5 figs.

13947 (JINR—D-14-87-799, pp 125-128) **Positive muon modelling of the hydrogen-metal system properties.** Karpov, S.B.; Miloserdin, V.Yu.; Mishchenko, A.Yu. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Muon diffusion in metals with fcc lattice is theoretically considered. Muon movement is considered in three-dimensional potential. Metal lattice distortion by muon connected with its movement in the lattice is taken into account. Wave functions in the potential considered are calculated using a computer. 5 refs.

13948 (JINR—D-14-87-799, pp 139-148) **Muon spin resonance study of quantum crystals and cryogenic fluids.** Krasnoperov, E.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The first experiments on studying quantum crystals (H/sub 2/) and cryoliquids (/sup 4/He) by MSR method are presented. Theoretical representations and models which qualitatively describe experimental situations connected with muon depolarization in solid and liquid hydrogen and liquid helium, are discussed. "Strange diffusion" effect consisting in the reduction of positive muon depolarization rate with the temperature decrease has persuasively proved the presence of quantum subbarrier coherent muon diffusion in hydrogen. 17 refs.; 5 figs.

13949 (JINR—D-14-87-799, pp 203-207) **Muonium and exchange-induced level shifts in magnetic semiconductors and dielectric materials.** Kuten', S.A.; Rapoport, B.I. (Belorusskij Gosudarstvennyj Univ., Minsk). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

To detect Mu in magnetic semiconductors and dielectrics it is proposed to effect its levels in a resonance way using radiofrequency magnetic fields. It is shown that the method proposed allows one to get information concerning exchange interactions of Mu electron with medium electrons from the measurements of μ/sup +/ spin precession frequency. 8 refs.

13950 (JINR—D-14-87-799, pp 456-460) **Hyperfine couplings of radioactive nuclei in solids.** Delyagin, N.N.; Sorokin, A.A. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Results of certain investigations into magnetic HFI for /sup 119/Sn and /sup 181/Ta nuclei, conducted in the MSU NIIYaF using Moessbauer effect and perturbed angular correlation (PAC) methods are briefly considered. Hyperfine field values for /sup 181/Ta in ZrFe, YFe/sub 2/ and LuFe/sub 2/ Laves phases as well as for /sup 111/Cd in ZrFe/sub 2/ and LuFe/sub 2/ are presented. HFI parameter analysis gives important information concerning interatomic interaction peculiarities and charge and spin density distributions determined by them. 11 refs.; 3 figs.; 2 tabs.

13951 (JINR—D-14-87-799, pp 23-33) **Recent LAMPF research using muons.** Bradbury, J.N. (Los Alamos National Lab., NM (USA)). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Recent results obtained at Los Alamos Meson Physics Facility (LAMPF) in programs involving pions and muons interacting with matter are discussed. The programs include muon-spin-relaxation experiments to study magnetic dynamics in spin glasses and electronic structure in heavy-fermion superconductors; muon channeling experiments to provide information on pion stopping sites in crystals. Experiments at LAMPF include new measurements of muon Knight shifts in U/sub 1-x/Th/sub x/Be/sub 13/. The catalysis of the d-t fusion reaction using negative muons has been investigated with some surprising results including a stronger than linear dependence of the mesomolecular formation rate on target density and the observation of 150 fusions per muon under certain conditions. 11 refs.; 7 figs.

13952 (JINR—D-14-87-799, pp 106-118) **Diffusion and localization of positive muons and pions in copper.** Seeger, A. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Theoretische und Angewandte Physik; Max-Planck-Institut fuer Metallforschung, Stuttgart (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The paper deals with the application of the muon spin rotation (μSR) techniques for measuring muon diffusivities D/sup μ/, the so-called Gurevich technique, and of the π/sup +//μ/sup +/ lattice-steering technique to copper. It illustrates in particular the supplementary character of these two methods. The temperature dependence (80 K - 330 K) of the transverse relaxation rate (tau/sub c/) in copper is interpreted as tunneling of the μ/sup +/ between adjacent interstitial sites. The muon diffusivity D/sup μ/ is intensely proportional to tau/sub c/. The π/sup +//μ lattice-steering data obtained on copper show that up to 250 K the experiments are fully compatible with octahedral (O) occupancy. Above 300 K the measurements are clearly incompatible with exclusive octahedral occupancy and suggest strongly that pions occupy tetrahedral interstices. A comparison between computed and measured lattice-steering profiles indicates that at 370 K the tetrahedral-to-octahedral occupancy ratio in thermal equilibrium is about unity. 53 refs.; 2 figs.; 3 tabs.

13953 (JINR—D-14-87-799, pp 129) **Study of π/sup +/ lattice site in copper by means of π/sup (sup +)//μ/sup +/ lattice-steering experiments.** Fabritius, G.; Gaul, Th.; Heinemann, V.; Herlac, D.; Maier, K.; Schimmele, L.; Seeger, A.; Widmann, E.; Wolf, U. (Max-Planck-Institut fuer Metallforschung, Stuttgart (Germany, F.R.). Inst. fuer Physik; Stuttgart Univ. (Germany, F.R.). Inst. fuer Theoretische und Angewandte Physik). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Time-differential π/sup +//μ/sup +/ lattice steering is shown to be an ideal tool for studying the problem of octahedral and tetrahedral occupancy. The technique enables one to determine the lattice sites occupied by implanted positive pions as a function of the pion age. In the temperature range between 80 K and 150 K the time-differential π/sup +//μ/sup +/ lattice steering observed on Cu along <100> is compatible with exclusive octahedral occupancy. 1 ref.

13954 (JINR—D-14-87-799, pp 188-197) **Models for the muonium defect centers in crystals.** Cox, S.F.J. (Rutherford Appleton Lab., Chilton (UK)). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Molecular radical models for varions muonium defect centres are reviewed and developed. Anisotropic hydrogen defect centres with properties analogous to Mu* have been detected in Si, Ge, GaAs, GaP and diamond. The molecular radical model relies heavily on tetrahedral hybrid orbitals being a good basis for the de-

scription of bonding. It also explains why Mu* centres are not seen in the more ionic binary compounds, where charge-density falls to zero between the ions. 20 refs.; 6 figs.

13955 **(PB—89-851919/XAB) Two-dimensional NMR spectroscopy: correlated, homonuclear-correlated, and nuclear Overhauser spectroscopy. January 1975-December 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-December 1988.** (National Technical Information Service, Springfield, VA (USA)). Dec 1988. 127p. NTIS PC N01/MF N01.

This bibliography contains citations concerning the enhanced analytical techniques of two-dimensional nuclear magnetic resonance (2-D NMR). Applications to specific molecules, biomolecules, and compounds as well as comparisons of three 2-D NMR techniques: correlated spectroscopy (COSY), nuclear Overhauser (NOSEY), and homonuclear-correlated spectroscopy (HOMCOR). (Contains 190 citations fully indexed and including a title list.)

13956 **(RAL—88-078) Companionship of neutron and photon magnetic scattering in condensed matter research.** Lovesey, S.W. (Rutherford Appleton Lab., Chilton (UK)). Sep 1988. 17p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705393/JAW.

The paper surveys the two processes of magnetic neutron and photon scattering. Cross sections for diffraction of photons by magnetic materials are discussed, together with polarisation induced interference terms. An expression for the photon amplitude that includes inelastic and resonance processes is provided. This provides a basis for a discussion of x-ray resonance exchange scattering.

13957 **(RAL—88-079) Resolution in deep inelastic neutron scattering using pulsed neutron sources.** Andreani, C.; Baciocco, G.; Holt, R.S.; Mayers, J. (Univ. di Tor Vergata, Roma (Italy). Dipt. di Fisica; Univ. 'La Sapienza', Roma (Italy). Dipt di Fisica). (Rutherford Appleton Lab., Chilton (UK)). Sep 1988. 28p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705394/JAW.

The principle components of the resolution function for deep inelastic neutron scattering experiments on pulsed neutron sources have been calculated directly in atomic momentum space. Analytical expressions for the relative contributions from the energy, angular and time resolutions are presented for both direct and indirect geometry spectrometers. The general trend in the behaviour of the resolution as a function of neutron energy and atomic mass is presented, and the results of numerical calculations for recoil scattering from hydrogen, helium and beryllium using the ISIS spectrometers HET and eVS, are given. It is shown that the resolution difference between HET and eVS is significantly reduced when compared in atomic momentum space rather than in energy space. Moreover, the contribution from the angular resolution term is only significant for atomic masses <4 au.

13958 **Thin-source concentration-dependent diffusion: A full solution.** Eng, G. (Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 3, 1518-1529(15 Jan 1989).

A new method of analysis is developed for solving the problem of an initially thin source of impurity ions diffusing into a host solid when the mechanism of transport involves a concentration-dependent diffusivity. In order to extract a diffusivity from experimental data we show that the fundamental experiment required is a measurement of the diffusion profile at two different times. The constant and the concentration-dependent contributions to the diffusivity then can be isolated by requiring the initial measured profile to propagate into the final measured profile. The analytic procedure presented here is shown to be a full solution to the problem of a diffusivity that varies linearly with concentration: $D(C) = D_0(1+\alpha C)$, where α is the strength of the nonlinear term. A matrix of orthogonal functions determines the time evolution for an arbitrary thin-source initial state. We show that the total diffusant amount is conserved and that the solution is naturally expressed as a power series in α. The persistence of curvature on ln(C)-vs-x^2 axes is then derived from the asymptotic (long-time) properties of the nonlinear equation solution. The solution up through order α^2 is then explicitly constructed for an arbitrary thin-source initial state.

6561 Superconductivity

REFER ALSO TO CITATION(S) 13136, 13778, 13946, 14030

13959 **(CNIC—00194) Tc, 2Δ/sub 0//K/sub B/T/sub c/ and parameters of phonon spectrum for amorphous superconductors.** Cao Xiaowen. (Academia Sinica, Hefei, AH (China). Inst. of Plasma Physics). (China Nuclear Information Centre, Beijing, BJ). Apr 1987. 22p. (AS-IPP—0001). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705069/JAW.

After the correlations between superconducting parameters T/sub C/ and 2Δ/sub 0/, the parameters of the phonon spectrum, λ, $<\omega>$, $<\omega$/sup 2/$>$ and Hall coefficient R/sub H/ and between the superconducting T/sub C/ and the parameters of the phonon spectrum ω/sub 0/ and $<\omega>/\omega$/sub 0/ were researched analytically. It had been found that there is a maximum of the above-mentioned both superconducting and the phonon spectrum parameters in the region of R/sub H/ = -3.5 to -4.0 x 10/sup -11/ m/sup 3//AS and that the materials having high ω/sub 0/ is favourable to obtain amorphous superconductors with high T/sub C/ as well as that the relation between T/sub C/ and the degree of the lattice disorder (i.e.$<\omega>/\omega$/sub 0/ value) is linear. On the basis of the above-mentioned results, a formula of T/sub C/ and 2Δ/sub 0//k/sub B/T/sub C/ of amorphous superconductors had been given. According to both proposed formula, it is noted for the first time that amorphous superconductor of the non-transition metals and their alloys is either a typical strong coupling superconductor which has a much larger 2 Δ/sub 0//k/sub B/T/sub C/ than BCS theory or a extreme weak coupling superconductor which has a much smaller 2 Δ/sub 0//k/sub B/T/sub C/ than BCS theory. Of coures, they can be also a weak coupling superconductor whose 2 Δ/sub 0//k/sub B/T/sub C/ is consistent with BCS theory or approximate to one. The reason that the measurement value of 2 Δ/sub 0//k/sub BTC/ of the weak coupling superconductors in the crystal state deviates obviously from BCS theory has been explained.

13960 **(DOE/FTR—9004954) [14th International Congress of the International Union of Crystallography, Perth and Sydney, Australia, August 12--20, 1987]: Foreign trip report.** Axe, J.D. (Brookhaven National Lab., Upton, NY (USA)). 30 Sep 1987. Contract AC02-76CH00016. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004954/JAW.

This report contains an informal account of the significant development which occurred at the Congress from the writer's personal prospective, notably in the areas of incommensurate structures, quasicrystals and high T/sub c/ superconductivity.

13961 **(IC—88/195) Thermodynamic characteristics of Y-Ba-Cu-O type compounds in the model of strong electron-phonon coupling.** Golubov, A.A. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 15p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705343/JAW.

Based on recently measured phonon density of states of Y-Ba-Cu-O an investigation of the strong electron-phonon coupling model is carried out. The numerical solutions of the real axis Eliashberg equations are obtained for a number of phonon spectra parameters. Isotope shifts of T/sub c/, spectral behavior of the pairing energy Δ(ω) and the ratio 2Δ/sub g//T/sub c/ (where Δ/sub g/ is the gap edge) are calculated. The model gives a small oxygen isotope shift for rather moderate values of the electron-phonon coupling constant $\lambda \sim 3$. The results strongly suggest the weak coupling with high frequency phonon modes and strong coupling with low frequency modes. (author). 22 refs, 3 figs.

13962 (IC—88/197) Energy gap in S- and D-wave pairing superconductors. Dolgov, O.V.; Golubov, A.A. (AN SSSR, Moscow. Fizicheskij Inst.). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 8p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705344/JAW.

The ratio 2Δ/sub g//T/sub c/, where Δ/sub g/ is the gap edge, T/sub c/ is the critical temperature, is calculated in the framework of the model of strong electron-phonon coupling. Both isotropic and anisotropic pairing cases are considered. It is shown that the isotropic Eliashberg model cannot account for the large values of the ratio 2Δ/sub g//T/sub c/ for the reasonable values of the electron-phonon coupling parameter λ, while anisotropic pairing can resolve this problem. (author). 7 refs, 3 figs.

13963 (IC—88/198) Localized versus itinerant picture of light-T/sub c/ superconducting oxides. Oles, A.M.; Zaanen, J. (International Centre for Theoretical Physics, Trieste (Italy); Max-Planck-Institut fuer Festkoerperforschung, Stuttgart (Germany, F.R.)). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 14p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705345/JAW.

The physical consequences of the model Hamiltonian which describes the Cu(3d/sub x/2/sub -y/2) and 0(2p/sub x(y)/) orbitals of CuO/sub 2/ planes in high-T/sub c/ superconducting oxides are discussed in the localized and itinerant regime. We show by a direct calculation that the hole correlations at Cu sites are strong and that the antiferromagnetic state of La/sub 2/CuO/sub 4/ and YBa/sub 2/Cu/sub 3/O/sub 6/ can be well described in terms of the itinerant model. (author). 40 refs, 4 figs.

13964 (IC—88/286) Nucleation of superconductivity in ceramic oxides. Saif, A.G.; Chela-Flores, J. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 10p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705364/JAW.

We discuss the nucleation of superconductivity in the interior of a bulk specimen, as well as at the surface of ceramic superconductors. We base our work on phenomenological equations, in which superconductivity coexists with antiferromagnetism. The prediction of the evolution of H/sub c(sub 2)/ with small variations on the coupling constant may serve to test the underlying phenomenological theory. (author). 15 refs.

6570 Theoretical And Mathematical Physics

REFER ALSO TO CITATION(S) 13311, 13743, 13844, 13845, 13846, 13912, 14086

13965 (AD-A—200078/4/XAB) Diffusion equations in duals of nuclear spaces. Technical report, September 1987-August 1988. Kallianput, G.; Mitoma, I.; Wolpert, R.L. (North Carolina Univ., Chapel Hill (USA). Center for Stochastic Precesses). Jul 1988. 67p. (TR—234). NTIS, PC A04/MF A01.

A stochastic Galerkin method is used to establish the existence of a solution to a martingale problem posed by an Ito-type stochastic differential equation for processes taking values in the dual of a nuclear space. Uniqueness of the strong solution is also shown using the monotonicity condition. An application to the motion of random strings is discussed.

13966 (AD-A—200336/6/XAB) Stochastic-evolution equations driven by nuclear-space-valued martingales. Kallianpur, G.; Perez-Abreu, V. (North Carolina Univ., Chapel Hill (USA). Dept. of Statistics). 1988. 37p. (TR—175). NTIS, PC A03/MF A01.

Pub. in Applied Mathematics and Optimization, Vol. 17, 237-272(1988).

This paper presents a theory of stochastic-evolution equations for nuclear-space-valued processes and provides a unified treatment of several examples from the field of applications. (C sub O,1) reversed evolution systems on countably Hilbertian nuclear spaces are also investigated.

13967 (BiBoS—277/87) Stochastic mechanics of fields in a general relativistic context: Problems and perspectives. De Falco, D. (Istituto Nazionale di Fisica Nucleare, Naples (Italy)). (Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS); Istituto Nazionale di Fisica Nucleare, Naples (Italy)). 1987. 16p. Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS).

The problem of a formulation of Nelson's stochastic mechanics of scalar fields in the context of general relativity is considered. The simple example of the scalar field in the Wightman vacuum state on the Rindler wedge is examined, the stochastic counterpart of the Fulling ambiguity of canonical quantization is formulated, and the role of the stochastic quantization is formulated, and the role of the stochastic mechanics of thermal mixtures, as formulated by Guerra and Loffredo, is analyzed in the solution, in the spirit of Davies and Unruh, of the above ambiguity. An overall picture emerges which, both in the explicit example considered here and in its straightforward generalizations to static submanifolds of more general space-times, confirms Smolin's point of view that stochastic quantization is a very natural conceptual frame in which to study the general non covariance of the distinction between quantum and thermal fluctuations.

13968 (CONF-8808136—2) Computer simulation of mixed classical-quantum systems. Kalia, R.K.; Vashishta, P. (Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005786/JAW.

From Condensed matter theories; Taxco, Mexico (14 Aug 1988).

We briefly review three important methods that are currently used in the simulation of mixed systems. Two of these techniques, path integral Monte Carlo or molecular dynamics and dynamical simulated annealing, have the limitation that they can only describe the structural properties in the ground state. The third so-called quantum molecular dynamics (QMD) method can provide not only the static properties but also the real-time dynamics of a quantum particle at finite temperatures. 10 refs.

13969 (IC—88/190) Soliton geometry and the vacuum gravitational field equations. Gurses, M. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 17p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705340/JAW.

A soliton geometry is introduced on manifolds with arbitrary dimensions. The usual soliton connection 1-form defined by Crampin et al. is recovered when the soldering form is a 0-form. It is shown that the vacuum Einstein field equations admit a soliton connection and a soldering 1-form. An associated linear equation with a spectral parameter of Einstein's vacuum field equations are found and some properties of this equation are explored. An example of a Baecklund transformation is also given. (author). 21 refs.

13970 (IC—88/192) Nonlinear partial differential equations on homogeneous spaces. Gurses, M.; Oguz, O.; Salihoglu, S. (Cukurova Univ., Adana (Turkey). Physics Dept.; International Centre for Theoretical Physics, Trieste (Italy); Istanbul Technical Univ. (Turkey). Physics Dept.). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 31p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705342/JAW.

The work of A.K.N.S. which is based on the s1(2,R) valued soliton connection is extended to obtain new integrable coupled nonlinear partial differential equations. This is achieved by assuming the soliton connection having values in a semisimple Lie, Kac-Moody, Lie super algebras. Extensions of some of the integrable nonlinear p.d.e's are given explicitly. In particular the coupled NLS equations on various homogeneous spaces and the coupled modified KdV equations are obtained on symmetric spaces. (author). 20 refs.

13971 **(IC—88/203) Second order degenerate elliptic equations.** Duong Minh Duc. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 22p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705347/JAW.

Using an improved Sobolev inequality we study a class of elliptic operators which is degenerate inside the domain and strongly degenerate near the boundary of the domain. Our results are applicable to the L/sup 2/-boundary value problem and the mixed boundary problem. (author). 18 refs.

13972 **(IC—88/206) New basis for trades.** Khosrovshahi, G.B.; Ajoodani-Namini, S. (International Centre for Theoretical Physics, Trieste (Italy); Tehran Univ. (Iran). Dept. of Mathematics and Computer Science). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 14p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705349/JAW.

A very fast algorithm to generate a semitriangular basis for trades consisting of minimal trades (sparsest basis) is given. By augmenting the elements of this basis, we construct an infinite family of 2-designs. (author). 8 refs.

13973 **(IC—88/207) Irreducible finite-dimensional representations of the Lie superalgebra gl(n/1) in a Gel'fand-Zetlin basis.** Palev, T.D. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 21p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705350/JAW.

All finite-dimensional irreducible representations of the general linear Lie superalgebra gl(n/1) are studied. For each representation a concept of a Gel'fand-Zetlin basis is defined. Expressions for the transformation of the basis under the action of the generators are written down. (author). 8 refs.

13974 **(IC—88/233) Integrable two dimensional supersystems.** Tripathy, K.C.; Tripathy, L.K. (International Centre for Theoretical Physics, Trieste (Italy); Delhi Univ. (India). Dept. of Physics and Astrophysics). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705355/JAW.

The integrability of two dimensional time-dependent classical systems is examined in N=2 superspace using Dirac's second class constraints. The invariants involving quadratic powers in velocities for super harmonic oscillator and super Kepler potentials have been derived. (author). 5 refs.

13975 **(IC—88/234) Contraction of Z/sub 2/ graded Lie algebras.** Tripathy, K.C.; Patra, M.K. (International Centre for Theoretical Physics, Trieste (Italy); Delhi Univ. (India). Dept. of Physics and Astrophysics). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 5p. (CONF-8806105—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705356/JAW.

From 17. international colloquium on group theoretical methods in physics; Quebec, Canada (27 Jun 1988).

The Inoenu-Wigner contraction scheme is extended to Z/sub 2/ graded Lie algebras. As an illustration, the contraction of Osp(1,2) Lie algebra is presented. The contraction yields the structure and representations of full BRS algebra. Some observations on the link between contraction (deformation) and cohomology theory are also furnished. (author). 5 refs.

13976 **(IC—88/235) Integrable three dimensional systems.** Tripathy, K.C.; Mishra, S.C. (International Centre for Theoretical Physics, Trieste (Italy); Delhi Univ. (India). Dept. of Physics and Astrophysics). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 6p. (CONF-8806105—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705357/JAW.

From 17. international colloquium on group theoretical methods in physics; Quebec, Canada (27 Jun 1988).

An earlier scheme of studying two dimensional (time dependent) integrable systems is extended to three dimensional systems of physical interest. (author). 7 refs.

13977 **(IC—88/257) Topics in Riemannian geometry.** Ezin, J.P. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 28p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705360/JAW.

The lectures given at the "5th Symposium of Mathematics in Abidjan: Differential Geometry and Mechanics" are presented. They are divided into four chapters: Riemannian metric on a differential manifold, curvature tensor fields on a Riemannian manifold, some classical functionals on Riemannian manifolds and questions. 11 refs.

13978 **(IC—88/258) N soliton solution for a class of the system of LS nonlinear wave interaction.** Guo Boling; Pan Xiude. (International Centre for Theoretical Physics, Trieste (Italy); Zhejiang Univ., Hangzhou (China)). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705361/JAW.

In this note, the explicit form of the N soliton solutions for a class of the system of LS nonlinear wave interaction has been obtained by using Hirota's method. (author). 6 refs.

13979 **(IC—88/266) Similarity transformations, the structure of the travelling waves solution and the existence of a global smooth solution to generalized Kuramoto-Sivashinsky type equations.** Guo Boling. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705362/JAW.

The existence of a global smooth solution for the initial value problem of generalized Kuramoto-Sivashinsky type equations have been obtained. Similarity solutions and the structure of the travelling waves solution for the generalized KS equations are discussed and analyzed by using the qualitative theory of ODE and Lie's infinitesimal transformations respectively. (author). 8 refs.

13980 **(IC—88/272) Maximal quotient BCK-algebras.** Ahsan, J.; Deeba, E.Y.; Thaheem, A.B. (King Fahd Univ. of Petroleum and Minerals, Dhahran (Saudi Arabia). Dept. of Mathematical Sciences; Houston Univ., TX (USA). Dept. of Applied Mathematical Sciences). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 22p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705363/JAW.

This paper initiates the study of the algebra of quotients associated with a given BCK-algebra, analogous to the classical rings of quotients and their subsequent generalizations. (author). 11 refs.

13981 **(IC—88/326) Sum rules in three-body problem at fixed angular momentum.** Merkuriev, S.P.; Kvitsinsky, A.A. (International Centre for Theoretical Physics, Trieste (Italy); Leningrad State Univ. (USSR). Theoretical Physics Dept.). (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 10p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705372/JAW.

A three particle system with a fixed total-angular momentum is considered. For the corresponding Schroedinger operator, a complete set of spectral sum rules is obtained. It relates the characteristics of the discrete spectrum with the S-matrix. (author). 5 refs.

13982 **(INS—704) Cosmological string theory with thermal energy.** Shiraishi, Kiyoshi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Sep 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756544/JAW.

An attempt to construct a cosmological scenario directly from string theory is made. Cosmological string theory was presented by Antoniadis, Bachas, Ellis and Nanopoulos. They also expect loop effects on cosmological string theory. In this paper, we point out the other importance of the one-loop effect, the finite temperature effect. The equations of motion for background geometry at finite temperature is given. We address a problem on derivation of the effective action at non-zero temperature.

13983 **(LA-UR—88-4103) Multigrid Monte Carlo methods.** Loh, E. Jr. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 11p. (CONF-880272—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005456/JAW.

From Computer simulation studies in condensed matter physics: recent developments; Athens, GA, USA (23 Feb 1988).

This paper is intended to be a tutorial on multigrid Monte Carlo techniques, illustrated with two examples. Path-integral quantum Monte Carlo is seen to take only a finite amount of computer time even as the paths are discretized on infinitesimally small scales. A method for eliminating critical slowing down completely{emdash}even for models with discrete degrees of freedom, as in Potts models, or discrete excitations, such as isolated vortices in the XY model{emdash}is presented. 11 refs., 1 fig.

13984 **(RAL—88-054) Proceedings of the school for young high energy physicists. Rutherford Appleton Laboratory, September 7-19 1987.** McCubbin, N.A. (ed.). (Rutherford Appleton Lab., Chilton (UK)). 1988. 206p. (CONF-8709356—). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88754966/JAW.

From School for young high energy physicists; Chilton, UK (7 Sep 1987).

The paper concerns the Proceedings of the 'School for Young High Energy Physicists', which was held at the Rutherford Appleton Laboratory, Sept. 1987. The lectures were presented in four courses, and were intended to give experimentalists a grounding in Relativistic Quantum Field Theory. The four lectures courses were each selected for INIS and indexed separately. (U.K.).

13985 **Reparametrizations and gauge and general-coordinate transformations in string field theory.** Das, S.R.; Rubin, M.A. (Fermi National Accelerator Lab., Batavia, IL (US));. pp v of Lewes string theory workshop. Clavelli, L.; Halprin, A. Teaneck, NJ; World Scientific Pub. Co. (1986). (CONF-8507153—).

From Lewes string theory workshop; Lewes, DE, USA (6 Jul 1985).

The authors relate reparametrizations of the parameter σ to point transformations of scalar field in "loop space," the configuration space of string field theory. Formulas are given for the changes induced by these transformations in the infinite set of "component" spacetime-tensor fields into which a scalar field on loop space may be decomposed. New derivative operators on loop space are defined, motivated by the parametrization-dependence of the mapping from loop space to spacetime. A generalization to loop space of the Einstein-Hilbert Lagrangian is proposed as a candidate for a 2nd-quantized string Lagrangian not tied to any preferred background geometry.

13986 **Gauge and general covariance of string interactions.** Das, S.R. (Fermi National Accelerator Lab., Batavia, IL (US));. pp v of Lewes string theory workshop. Clavelli, L.; Halprin, A. Teaneck, NJ; World Scientific Pub. Co. (1986). (CONF-8507153—).

From Lewes string theory workshop; Lewes, DE, USA (6 Jul 1985).

All fundamental interactions at observable energies seem to arise out of local symmetries - gauge invariances and general coordinate invariance. In usual field theories of point particles these invariances are postulated a priori: the idea is to deduce everything else from the symmetry group and the representation content of the matter fields. In string theories, the situation is rather different. Here the basic principle is reparametrization invariance on the world sheet swept out by the string. The authors consider the simplest string models-those defined on flat Minkowski space-time. The transverse oscillations of the string lead to an infinite tower of modes which may be thought of as the "particles" constituting the string. The interacting string theory is defined, in the first quantized formulation, by specifying the interaction of these modes with the string. These interaction vertices must satisfy a basic requirement: when any dual amplitude is factorized only physical states (i.e. those satisfying the Virasoro conditions) must occur as on-mass-shell intermediate states. This means that the vertices respect the reparametrization invariance of the world sheet, since it is this symmetry which eliminates ghost states by virtue of Virasoro conditions.

13987 **Toward a covariant string field theory.** Raby, S.; Slansky, R.; West, G. (Theoretical Div., T-8, MS B285, Los Alamos National Lab., Los Alamos, NM (US));. pp v of Lewes string theory workshop. Clavelli, L.; Halprin, A. Teaneck, NJ; World Scientific Pub. Co. (1986). (CONF-8507153—).

From Lewes string theory workshop; Lewes, DE, USA (6 Jul 1985).

The authors identify the physical degrees of freedom in the string field using the equations of motion, gauge conditions and residual gauge invariance of the system. They also present a first step towards obtaining a covariant string field theory.

70 FUSION ENERGY

REFER ALSO TO CITATION(S) 13474

13988 **(INIS-SU—46) Experimental and theoretical physics. Collection.** Basov, N.G. (ed.). (AN SSSR, Moscow. Fizicheskij Inst.). 1987. 55p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780011/JAW.

The individual papers in this collection have been abstracted and indexed separately.

13989 **(KFK—4277) 1986 progress report on R and D work of the Nuclear Fusion Project (PKF). Annual report under the association degreement between Karlsruhe Nuclear Research Center and Euratom.** Kast, G. (comp.). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion; Association Euratom-Kernforschungszentrum Karlsruhe G.m.b.H. (KFK) (Germany, F.R.)). Mar 1987. 79p. (In German). (EUR—10536d). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756515/JAW.

The Kernforschungszentrum Karlsruhe (KfK) and the Max-Planck-Institute for Plasma Physics, Garching, have joined to form the Entwicklungsgemeinschaft Kernfusion, and under this roof perform research work on the physical and technical conditions and requirements of using the energy from nuclear fusion, and to plan the design and the construction of the necessary equipment for future large-scale experiments. The activities of the KfK for the development of fusion devices with magnetic confinement have been concentrated in the Nuclear Fusion Project, which cooperates in the European Fusion Technology Programme, on the basis of an association agreement between KfK and Euratom, supported by the European Commission. Supplementary KfK contributions, studies in most cases, create a connection between various fields of work, and prepare the road for new tasks, which in the years to come will be found in the extension of the Fusion Technology Programme and the planning work for NET. The reports collected in this annual survey are contributions from KfK Institutes of the year 1986. An annex presents the Easks taken over by KfK within the Fusion Technology Programme of the EC, and notes on the KfK Institutes taking part in the particular activities facilitate reference to the individual, full-text reports.

7001 Plasma Research

REFER ALSO TO CITATION(S) 14056

13990 **(AD-A—200312/7/XAB) Alfven waves in a cold plasma with curved magnetic fields. Final report, 1 January 1985-31 December 1986.** Carrion, P.M.; Hasegawa, A.; Patton, W.; Prakash, M. (Columbia Univ., New York (USA). Henry Krumb School of Mines). Jun 1988. 39p. NTIS, PC A03/MF A01.

A set of linearized magnetohydrodynamic equations was reduced to the reflectivity equation for the compressional magnetic perturbations in the framework of the Radoski model. It is shown that the reflection coeficient is a function of the inhomogeneities of

the magnetic field, and the inhomogeneities of the Alfven velocity. An interesting property of the reflectivity equation is that, near Alfven resonant magnetic-force lines, this equation reduces to the curvature-free Budden equation. Near Alfven resonances, the curvature does not play a significant role and Budden's asymptotics in time can be applied to the wave field near the magnetic-force lines where the Alfven dispersion relation holds.

13991 **(CEA-R—5463) Data base in atomic physics: ficato-ficspi, used in the collisional - radiative model Lasix.** Jacquemot, S. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Oct 1988. 152p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756660/JAW.

This report describes the atomic structure of ions that are studied in the kinetic code LASIX, and the various processes that act in and between them, and then compares the various formulations with special attention to neon-like ions, selenium in particular.

13992 **(DOE/ER/52127—27) Electron currents in field reversed mirror dynamics: Theory and hybrid simulation.** Stark, R.A. (Illinois Univ., Urbana (USA)). 1987. Contract FG02-86ER52127. 255p. NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005821/JAW.

To model the dynamics of the Field-Reversed Mirror (FRM) as a whole we have developed a 1-D radical hybrid code which also incorporates the above electron null current model. This code, named FROST, models the plasma as azimuthally symmetric with no axial dependence. A multi-group method in energy and canonical angular momentum describes the large-orbit ions from the beam. Massless fluid equations describe electrons and low energy ions. Since a fluid treatment for electrons is invalid near a field null, the null region electron current model discussed above has been included for this region, a unique feature. Results of simulation of neutral beam start-up in a 2XIIB-like plasma is discussed. There FROST predicts that electron currents will retard, but not prevent reversal of the magnetic field at the plasma center. These results are optimistic when compared to actual reversal experiments in 2XIIB, because there finite axial length effects and micro-instabilities substantially deteriorated the ion confinement. Nevertheless, because of the importance of the electron current in a low field region in the FRM, FROST represents a valuable intermediate step toward a more complete description of FRM dynamics. 54 refs., 50 figs., 3 tabs.

13993 **(DOE/ER/52127—36) Tokamak burn control.** Sager, G.T. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). Jun 1988. Contract FG02-86ER52127. 118p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005822/JAW.

Research of the fusion plasma thermal instability and its control is reviewed. General models of the thermonuclear plasma are developed. Techniques of stability analysis commonly employed in burn control research are discussed. Methods for controlling the plasma against the thermal instability are reviewed. Emphasis is placed on applications to tokamak confinement concepts. Additional research which extends the results of previous research is suggested. Issues specific to the development of control strategies for mid-term engineering test reactors are identified and addressed. 100 refs., 24 figs., 10 tabs.

13994 **(DOE/ER/53236—T1) High beta and second region stability analysis and ICRF edge modeling: Progress report.** (Grumman Aerospace Corp., Princeton, NJ (USA). Corporate Research Center). 1988. Contract FG02-86ER53236. 41p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005755/JAW.

This report describes the tasks accomplished under Department of Energy contract No. FG02-86ER53236 in modeling the edge plasma- antenna interaction that occurs during Ion Cyclotron Range of Frequency (ICRF) heating. This work has resulted in the development of several codes which determine kinetic and fluid modifications to the edge plasma. When used in combination, these codes predict the level of impurity generation observed in experiments on the Princeton Large Torus. In addition, these models suggest improvements to the design of ICRF antennas. Also described is progress made on high beta and second region analysis. Code development for a comprehensive infernal mode analysis code is nearing completion. A method has been developed for parameterizing the second region of stability and is applied to circular cross section tokamaks. Various studies for high beta experimental devices such as PBX-M and DIII-D have been carried out and are reported on. 19 refs., 8 figs., 1 tab.

13995 **(DOE/ET/51013—253) TSC [Tokamak Simulation Code] simulations of Alcator C-MOD discharges: I, A vertically symmetric scenario.** Ramos, J.J. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Jul 1988. Contract AC02-78ET51013. 41p. (PFC/RR—88-9). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005895/JAW.

The Tokamak Simulation Code (TSC) is used to model the evolution of a full performance three second discharge of the Alcator C-MOD tokamak. Perfect symmetry about the equatorial plane is assumed in this simulation. 1 ref., 29 figs.

13996 **(ENEA-RT-FUS—86-3) Non-uniform pressure driven cylindrical compression of ideal gases and real matters.** Atzeni, S.; Caruso, A.; Pais, V. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Sep 1986. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755393/JAW.

The numerical study of the implosion of a cylinder driven by an azimuthally varying pressure has shown that two regimes can exist for the evolution. In the first regime, the cylinder implodes almost symmetrically; while in the second, energetic jets appear behind the shock wave, thus destroying the implosion uniformity. Scaling laws for the threshold of the transition between these two regimes are given as a function of the relevant dimensionless parameters for both idealgases and real matter.

13997 **(ENEA-RT-FUS—86-5) Parametric instabilities in the lower hybrid frequency range in the FT tokamak.** Cesario, R.; Pericoli-Ridolfini, V. (ENEA, Rome (Italy)). Sep 1986. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755389/JAW.

An overall view of the phenomena observed with radiofrequency (RF) probes during lower hybrid wave injection is presented for several operational regimes of the FT tokamak. We mainly focus on the high plasma density regime where the effects of the launched waves on the main plasma become negligible. A rather rich spectrum from about 0 MHz to beyond the injected frequency is observed in response to the RF pulse. Many secondary peaks, or sidebands, shifted from the pump by multiples of the ion cyclotron frequency evaluated at the outer torus edge appear, while the pump spectrum is strongly broadened. Evidence of the primary importance of the border plasma conditions is recognized. Using a numerical code, wesatisfactorily reproduced part of the experimental data concerning the decay process which creates the sideband. We considered the decay of the pump in a quasi mode strongly damped on ions and took into account the convection losses due to the finite extension of the pump. The key to the good agreement between the numerical simulations and the experiment was to attribute a main plasma parameter, i.e., density and current.

13998 **(ENEA-RT-FUS—86-10) Measurements of tritium burn-up in low q discharges in the FT tokamak.** Batistoni, P.; Martone, M.; Pillon, M.; Podda, S.; Rapisarda, M. (ENEA, Rome (Italy)). Feb 1987. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755394/JAW.

The 1.01 MeV triton burn-up in Ft deuterium discharges has been investigated by the measurement of 14.1 MeV and 2.45 MeV neutro emission. At large values of limiter q, the burn-up is found to increase with plasma current as expected; around limiter $q = 3$, a reduction is observed, while for lower limiter q values, bur-up seems to increase again, but it is more erratic.

13999 **(ENEA-RT-FUS—86-11) Using Co/sub 2/-laser scattering, detection of lower hybrid wave of FT tokamak.** Orsitto, F.; Frigione, D. (ENEA, Rome (Italy)). Feb 1987. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755395/JAW.

Results of a CO/sub 2/ laser scattering experiment on lower hybrid waves at a frequency of 2.45 GHz are given. Signals are found, in the location predicted, by a ray-tracing code. The parallel refraction index (n/sub 11/)-spectrum of LH waves is determined at the plasma center showing a high n/sub 11/ depletion with respect to the launched spectrum in the scattering volume.

14000 **(IPF—87-5) Plasma focus and Z-pinch.** Schmidt, H. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Plasmaforschung). Nov 1987. 32p. (CONF-8702156—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754843/JAW.

From 2. Latin American workshop on plasma physics and controlled thermonuclear fusion; Medellin, Colombia (16 Feb 1987).

This report shows the progress made in understanding the processes occurring in the plasma focus.

14001 (IPPJ—863, pp 34-46) **Simulation of driven reconnection by a high precision MHD code.** Kusano, Kanya; Ouchi, Yasuo; Hayashi, Takaya; Horiuchi, Ritoku; Watanabe, Kunihiko; Sato, Tetsuya. (Hiroshima Univ. (Japan). Faculty of Science). Mar 1988. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780049/JAW. (CONF-8703311—).

From 2. U.S.-Japan workshop on advanced plasma modeling; Nagoya, Japan (23 Mar 1987).

A high precision MHD code, which has the fourth-order accuracy for both the spatial and time steps, is developed, and is applied to the simulation studies of two dimensional driven reconnection. It is confirm that the numerical dissipation of this new scheme is much less than that of two-step Lax-Wendroff scheme. The effect of the plasma compressibility on the reconnection dynamics is investigated by means of this high precision code.

14002 (IPPJ—863, pp 62-75) **Macroscale particle simulation of kinetic Alfven waves.** Tanaka, Motohiko; Sato, Tetsuya; Hasegawa, Akira. (Hiroshima Univ. (Japan). Inst. for Fusion Theory). Mar 1988. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780049/JAW. (CONF-8703311—).

From 2. U.S.-Japan workshop on advanced plasma modeling; Nagoya, Japan (23 Mar 1987).

Simulation of the kinetic Alfven wave, which has many applications in space and fusion plasmas, has been performed by using macroscale (magnetohydrodynamic scale) particle simulation code. Dispersion properties and wave-particle interactions of the kinetic Alfven wave (such as Landau damping and electron acceleration) are successfully obtained in the simulation.

14003 (IPPJ—863, pp 100-129) **Reduced atomic model for calculation of charge state distribution in multiply-charged plasmas.** Yabe, Takashi. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). Mar 1988. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780049/JAW. (CONF-8703311—).

From 2. U.S.-Japan workshop on advanced plasma modeling; Nagoya, Japan (23 Mar 1987).

A method to treat particle production and annihilation in particle code is proposed. This method does not directly produce particles and hence can be used with less noise. An example is given for a beat wave accelerator. The density change of 0.06 % during one plasma period can seriously affect the excitation of plasma waves. In addition, a new method to economically solve atomic processes is proposed, which can be coupled with particle codes. Finally, the coupling between non-LTE free and bound electrons is analyzed with a simple analytical model and its importance in real systems is pointed out.

14004 (IPPJ—863, pp 91-99) **Numerically induced stochasticity and long-time behavior of numerical trajectories - small ΔT analysis.** Friedman, A.; Auerbach, S.P. (Lawrence Livermore National Lab., CA (USA)). Mar 1988. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780049/JAW. (CONF-8703311—).

From 2. U.S.-Japan workshop on advanced plasma modeling; Nagoya, Japan (23 Mar 1987).

In a one-dimensional anharmonic potential well, the period of an orbit is a function of its energy. The true motion in such a well is regular, since energy conservation constrains the velocity at each value of the coordinate. Nontheless, when the orbit is computed numerically, stochastic behavior can result. The phenomenon of numerically induced stochasticity has significance in several contexts. Firstly, a numerical investigation of the regions of phase space accessible to an orbit may lead to erroneous results, if the timestep is too large or the mover inappropriate. Furthermore, conclusions about orbital stability based on numerical integrations may be erroneous, since neighboring chaotic orbits diverge exponentially, even if the chaos is numerically induced. When studying the dynamics of a physical system, one should demonstrate that any chaos observed is not numerically induced. Also, linearized simulations of collective phenomena must avoid numerically induced stochasticity, since the zero-order and perturbed trajectories are 'neighboring'. Finally, trajectory crossings in PIC simulations can lead to enhanced noise and other errors. In addition to these investigations, an analysis is also made of the long-term behavior of numerical trajectories (small ΔT analysis). (Nogami, K.).

14005 (IPPJ—863, pp 130-134) **Independent particle timesteps.** Friedman, A. (Lawrence Livermore National Lab., CA (USA)). Mar 1988. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780049/JAW. (CONF-8703311—).

From 2. U.S.-Japan workshop on advanced plasma modeling; Nagoya, Japan (23 Mar 1987).

A long-standing goal in plasma simulation has been a method which could treat both detailed kinetic physics and smooth large-scale physics in an efficient and natural way. The present study is aimed at developing a new particle-in-cell plasma simulation technique which relaxes major restrictions and would be suitable for strongly inhomogeneous problems involving a wide range of space and time scales. It seems only natural to advance each particle with its own, independent, series of timesteps; one could imagine using (for example) an ODE solver such as LSODE. The major difficulty in doing this has been the necessity of processing the particles in synchrony due to the requirement of a self-consistent field. The authors have developed in outline an algorithm which may overcome this difficulty. The code would advance the particles in blocks, each with an associated timestep. For each region of phase space, the nominal timestep (and possibly the mesh spacing) could be chosen in an adaptive manner. There are many areas of plasma physics where such capability would be highly desirable, including sheaths at the interface of a plasma with a probe or wall, collisionless shocks, double layers, and a wide variety of astrophysical problems. (Nogami, K.).

14006 **(IPPJ—863) Proceedings of the US-Japan workshop on advanced plasma modeling, 2.** (Nagoya Univ. (Japan). Inst. of Plasma Physics). Mar 1988. Vp. (CONF-8703311—). NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780049/JAW.

From 2. U.S.-Japan workshop on advanced plasma modeling; Nagoya, Japan (23 Mar 1987).

The papers presented at this meeting were abstracted and indexed individually.

14007 **(IPPJ—877) Structural instability of sheath potential distribution and its possible implications for the L/H transition in tokamak plasmas.** Yoshida, Zensho; Yamada, Hiroshi. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jul 1988. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756548/JAW.

The Bohm equation of electrostatic potential distributions in one-dimensional plasmas has been studied for various Mach numbers and plasma potentials. Solvability and structural stability have

been discussed using the Sagdeev potential. Implications of the structural stability for the L/H transitions in tokamak plasmas has been also discussed.

14008 **(IPPJ—878) Study of critical beta non-circular tokamak equilibria sustained in steady state by beam driven currents.** Okano, K.; Ogawa, Y.; Naitou, H. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jul 1988. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756549/JAW.

A new MHD-equilibrium/current-drive analysis code was developed to analyse the high beta tokamak equilibria consistent with the beam driven current profiles. In this new code, the critical beta equilibrium, which is stable against the ballooning mode, the kink mode and the Mercier mode, is determined first using MHD equilibrium and stability analysis codes (EQLAUS/ERATO). Then, the current drive parameters and the plasma parameters, required to sustain this critical beta equilibrium, are determined by iterative calculations. The beam driven current profiles are evaluated by the Fokker-Planck calculations on individual flux surfaces, where the toroidal effects on the beam ion and plasma electron trajectories are considered. The pressure calculation takes into account the beam ion and fast alpha components. A peculiarity of our new method is that the obtained solution is not only consistent with the MHD equilibrium but also consistent with the critical beta limit conditions, in the current profile and the pressure profile. Using this new method, β {similar←to} 21 % bean and β {similar←to} 6 % D-type critical beta equilibria were scanned for various parameters; the major radius, magnetic field, temperature, injection energy, etc. It was found that the achievable Q value for the bean type was always about 30 % larger than for the D-type cases, where Q = fusion power/beam power. With strong beanness, Q {similar←to} 6 for DEMO type tokamaks ({similar←to}500 MWth) and Q {similar←to} 20 for power reactor size (4.5 GWth) are achievable. On the other hand, the Q value would not exceed sixteen for the D-type machines.

14009 **(IPPJ—879) Neoclassical resonant-plateau transport in the noncircular equipotential surface of a tandem mirror.** Katanuma, I.; Kiwamoto, Y.; Ishii, K.; Yatsu, K.; Miyoshi, S. (Tsukuba Univ., Ibaraki (Japan). Plasma Research Center). (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jul 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756550/JAW.

Neoclassical resonant-plateau transport in a minimum-B anchored tandem mirror is calculated in an experimentally observed case that a magnetic flux tube of an equipotential contours is not circular at the central cell.

14010 **(IPPJ—881) Gas-contact cooling for VUV laser oscillation in recombining plasmas.** Furukane, Utaro; Sato, Kuninori; Oda, Toshiatsu. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jul 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756552/JAW.

High potentiality leading to rapid cooling of a high temperature plasma is investigated in a gas contact cooling method in which the effect of finite time for mixing the plasma and the contact gas is considered. The calculation has shown that the cooling is much more rapid than the radiative loss cooling and that the gain per unit length of the HeII 164 nm is {similar←to}2 cm/sup -1/ for the laser oscillation under an optimum condition. Possibility of realizing a shorter wavelength laser is also discussed in a plasma with higher charge number Z.

14011 **(IPPJ—884) Monte Carlo study of ion cyclotron resonance heating in helical systems.** Ohnishi, Masami; Okamoto, Masao; Abe, Yoshihiko; Fukuyama, Atsushi; Mutoh, Takashi; Iiyoshi, Atsuo. (Kyoto Univ., Uji (Japan). Inst. of Atomic Energy). (Nagoya Univ. (Japan). Inst. of Plasma Physics). Aug 1988. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756554/JAW.

We study the ion cyclotron resonance heating (ICRH) by the minority scheme in helical systems by a Monte Carlo calculation. For the helical device with the toroidal pitch number of 14, the ratio of the energy deposited to the plasma to the total wave energy absorbed by the minority of protons amounts to 70 % and the ratio of the energy loss due to the drift loss of the minority ions is only 10 %. As the toroidal pitch number of the helical magnetic field decreases, the fraction of deposition energy decreases in proportion as the deterioration of the confinement of fast ions. However, since the modulation of helical winding laws and/or the shift of a plasma column can improve the confinement of fast ions, the ICRH can be expected to be an efficient means for plasma heating in helical systems with the medium pitch number (M = 10 {similar←to} 14) and the appropriate pitch modulation of the helical coils.

14012 **(JAERI-M—88-175) Study of particle confinement in the JT-60 tokamak using skin radiative approximation model.** Koide, Sinji; Shimizu, Katsuhiro; Sugiyama, Takashi; Nishitani, Takeo. (Nagoya Univ. (Japan). Inst. of Plasma Physics). (Japan Atomic Energy Research Inst., Tokyo). Sep 1988. 51p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756574/JAW.

In order to analyse the particle behavior of hydrogen plasma from the observation data of Hα line, 'Skin Radiative Approximation Model' has been newly proposed. The characteristics of particle confinement and recycling of ohmically heated plasma in the JT-60 tokamak are investigated by this model using Hα data of observed eight sight lines. As a result, it is inferred that recycled particles in the divertor influence the estimation of particle confinement time in comparison with that of analysis from the function fitting method using the data of three vertical sight lines.

14013 **(JAERI-M—88-179) Module type flat-field grazing incidence spectrographs for large TOKAMAK (JT-60) plasma diagnosis. Design and imaging properties.** Nagata, Hiroshi; Shiho, Makoto; Sugie, Tatsuo. (Nikon Corp., Tokyo (Japan)). (Japan Atomic Energy Research Inst., Tokyo). Sep 1988. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756576/JAW.

Module type flat-field grazing incidence spectrographs equipped with holographic grating are designed for the impurity diagnosis of large TOKAMAK (JT-60) plasma in the wavelength region of 0.5 - 122 nm. The spectrographs are with common size, and they cover different wavelength regions by changing the grating. The design requirement and characteristics of the spectrographs are summarized. Optical design and designed properties are discussed. The preliminary tests with photographic plates are examined, and many spectra including Al Kα (0.83 nm) are recorded. These spectrographs show the designed flat-field character, and sufficient wavelength resolution for plasma diagnosis.

14014 **(JET-R—88-06) Ionization, recombination and radiation of impurities in plasmas. An interactive atomic data and applications structure.** Summers, H.P.; Wood, L. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). Apr 1988. 103p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755549/JAW.

The paper describes the structure of an atomic database for application to impurity problems in fusion plasmas. It is designed for interactive computer use by both specialists in atomic physics and those concerned with plasma interpretation and diagnostics. Thus it contains data entry as well as data extraction and manipulation procedures. The detailed description of the methodology and its basis in atomic physics is described in sections 1 and 2. Section 3 and appendix C describes the practical implementation, and in particular its operation from the JET IBM SPF panel system. Section 4 is a technical discussion of data sources.

14015 **(JET-R—88-09) Comparison study of the 1MeV triton burn-up in JET using the HECTOR and SOCRATE codes.** Gorini, G.; Kovanen, M.A. (Scuola Normale Superiore, Pisa (Italy); Lappeenranta Univ. of Technology (Finland); National Research Council for Technology (Finland)). (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). 1988. 13p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705386/JAW.

The burn-up of the 1MeV tritons in deuterium plasmas has been measured in JET for various plasma conditions. To interpret these measurements the containment, slowing down and burn-up of fast tritons needs to be modelled with a reasonable accuracy. The numerical code SOCRATE has been written for this specific purpose and a second code, HECTOR, has been adapted to study the triton burn-up problem. In this paper we compare the results from the two codes in order to exclude possible errors in the numerical models, to assess their accuracy and to study the sensitivity of the calculation to various physical effects.

14016 **(SFB—162-86-N4-154) Resonance cone method for diagnostics of magnetized plasmas.** Piel, A. (Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 162 - Plasmaphysik Bochum/Juelich). Jun 1986. 229p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88756519/JAW.

The resonance cone of a HF antenna in a magnetoplasma can be used for plasma diagnostics in the laboratory, in the ionosphere and in cosmic space near the earth planet, over an extensive range of electron density. The theoretical part shows that the quasi-electrostatic approximation can handle thermal, electromagnetic and drift effects simultaneously. Measurement of temperature, density and drift velocity is discussed in the framework of analytical expressions. The method is analytically generalized for non-thermal distribution functions, which makes it valid for plasmas with non-Maxwellian electron distribution functions (such non-equilibrium is expected in the polar ionosphere). The influence of kinetic damping is numerically treated. Experimentally the limiting case of cold plasma is examined, with direct use of the resonance cone for measurement of the density. For stationary thermal plasma the validity of formulae for temperature effects is examined as well as the topological variation of the resonance cone, the influence of Landau damping and the method's usefulness for high-density plasmas. The effects of plasma drift and beam-plasma interaction on the resonance cone in non-thermal plasmas are discussed.

14017 **(SFB—162-88-N4-173) Resonance cones in non-Maxwellian plasmas.** Oelerich-Hill, G.; Piel, A. (Bochum Univ. (Germany, F.R.). Inst. fuer Experimentalphysik 2). (Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 162 - Plasmaphysik Bochum/Juelich). May 1988. 52p. Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 162 - Plasmaphysik Bochum/Juelich.

Resonance cones are studied experimentally in hot drifting plasmas and in various beam-plasma situations. In a drifting plasma the upstream-downstream asymmetry of the main cone is suitable for diagnostics of plasma drifts. The evaluation of electron temperature from the interference pattern is discussed in terms of the low-temperature-low-drift-approximation (LTLDA) and by comparing with numerical kinetic theory calculations. In this way the range of applicability of this method is extended above the LTLDA. In a beam-plasma situation, the downstream resonance cone exhibits a new interference pattern, which can be attributed to resonant particle effects. The upstream resonance cone is only slightly affected and is found still applicable for T/sub e/ and n/sub e/ diagnostics. As a result of the comparison with numerical calculations, in which the actual distribution function is used, the downstream interference pattern is proposed to be useful as a diagnostic method for obtaining the mean beam energy. The waves generated by the beam plasma interaction are analyzed by digital cross-correlation techniques. They are found to be Whistler waves propagating obliquely to the magnetic field direction at the resonance cone angle.

14018 **(SFB—162-88-N4-176) Experimental and numerical study of electromagnetic effects on resonance cones.** Kortshagen, U.; Piel, A. (Bochum Univ. (Germany, F.R.). Inst. fuer Experimentalphysik 2). (Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 162 - Plasmaphysik Bochum/Juelich). Jul 1988. 33p. Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 162 - Plasmaphysik Bochum/Juelich.

Resonance cone (r.c.) diagnostic is usually based on kinetic theory within the electrostatic approximation. Numerical and experimental results are presented, which reveal the influence of the neglected electromagnetic terms in the dispersion relation. In the near field a shift of the r.c. towards smaller angles occurs, which may be important at high electron desities and temperatures. In the far field the phase variation inside the cone turns out to be useful as a new electron density diagnostic in the regime of high densities, where r.c. diagnostic was previously not applicable.

14019 **(UCRL—96669) The Microwave Tokamak Experiment (MTX).** Thomassen, K.I.; Cohen, B.I.; Hooper, E.B.; Lang, D.D.; Nevins, W.M. (Lawrence Livermore National Lab., CA (USA)). 2 Oct 1987. Contract W-7405-ENG-48. 6p. (CONF-871007—104). NTIS, PC A02. Order Number DE88016976/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

A new experimental facility is being assembled at the Lawrence Livermore National Laboratory (LLNL) for studying microwave propagation and absorption in high density plasmas. A unique feature of the facility is the free electron laser (FEL) used to generate high peak power microwaves at 250 GHz, at a repetition rate so as to produce up to 2 MW of average power for up to 30 s. Called the Microwave Tokamak Experiment (MTX), the facility will be used for studies of plasma heating, current drive, and confinement.

14020 **(UCRL—97226) Four-frame gated optical imager with 120-ps resolution.** Young, P.E.; Hares, J.D.; Kilkenny, J.D.; Phillion, D.W.; Campbell, E.M. (Lawrence Livermore National Lab., CA (USA)). 11 Aug 1987. Contract W-7405-ENG-48. 14p. (CONF-8708110—42). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005659/JAW.

From 31. SPIE annual international technical symposium on optical and optoelectronic applied science and engineering; San Diego, CA, USA (16 Aug 1987).

In this paper we describe a framing camera capable of four separate two-dimensional images with each frame having a 120-ps gate width. The time separation between frames can be selected arbitrarily. Fast gating of a single frame is accomplished by using a standard wafer image intensifier tube in which the cathode is capacitively coupled to a conducting mesh placed over the input window of the tube. The mesh is then pulsed relative to the microchannel plate by a narrow (120 ps), high-voltage pulse. The transmission of the tube as a function of time has been verified using a laser-diode pulser and is approximately Gaussian with a FWHM of 120 ps. Multiple frames are obtained using multiple gated tubes which can then share a single bias supply and pulser with relative gate times selected by the cable lengths between the tubes and the pulser. A beamsplitter system has been constructed which produces a separate image for each tube from a single scene. In the present system, the tubes use S-20 photocathodes with an 18 mm diameter and quartz input windows. Spatial resolution is unchanged between d.c. and fast gated operations and has been measured to 10 lp/mm. Applications to time-dependent behavior in laser-produced plasmas will be presented. 7 figs.

14021 **(UCRL—98940) Modeling of induction-linac based free-electron laser amplifiers.** Jong, R.A.; Fawley, W.M.; Scharlemann, E.T. (Lawrence Livermore National Lab., CA (USA)). Dec 1988. Contract W-7405-ENG-48. 13p. (CONF-890154—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004806/JAW.

From Modeling and simulation of laser systems; Los Angeles, CA, USA (17 Jan 1989).

We describe the modeling of an induction-linac based free-electron laser (IFEL) amplifier for producing multimegawatt levels of microwave power. We have used the Lawrence Livermore National Laboratory (LLNL) free-electron laser simulation code, FRED, and the simulation code for sideband calculations, GINGER for this study. For IFEL amplifiers in the frequency range of interest (200 to 600 GHz), we have devised a wiggler design strategy which incorporates a tapering algorithm that is suitable for free-electron laser (FEL) systems with moderate space-charge effects and that minimizes spontaneous noise growth at frequencies below the fundamental, while enhancing the growth of the signal at the fundamental. In addition, engineering design considerations of the waveguide wall loading and electron beam fill factor in the waveguide set limits on the waveguide dimensions, the wig-

gler magnet gap spacing, the wiggler period, and the minimum magnetic field strength in the tapered region of the wiggler. As an example, we shall describe an FEL amplifier designed to produce an average power of about 10 MW at a frequency of 280 GHz to be used for electron cyclotron resonance heating of tokamak fusion devices. 17 refs., 4 figs.

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REFER ALSO TO CITATION(S) 12968, 12968, 13758, 13992, 14020

14022 **(AD-A—200219/4/XAB) Modeling of atomic processes for x-ray-laser plasmas. Final report, 15 June 1986-14 February 1988.** Gupta, U. (Berkeley Research Associates, Springfield, VA (USA)). Jul 1988. 76p. (BRA—89-W010R). NTIS, PC A05/MF A01.

This work dealt with the theoretical modeling and computation of photoionization, photoexcitation, radiative decay, and radiative recombination processes for multielectron atoms and ions in plasmas. Such atomic processes lead to and influence lasing in x-ray lasers operating both in the soft- and hard-x-ray regions. This research utilized a two-component, finite temperature, self consistent density functional method and demonstrated that this method is applicable for arbitrary plasma density and temperature and is capable of accurately treating multielectron ions of arbitrary Z. Electron-collisional ionization and excitation processes were investigated. These processes are an important mechanism through which population inversion of ionic energy levels lead to lasing in the soft x-ray region. Previously, theoretical calculations utilizing a semi-classical impact approximation were performed. In many cases such a method is inadequate. Computations were carried out by electron-impact ionization and excitation cross sections and rate coefficients utilizing the distorted wave with exchange method.

14023 **(CEA-CONF—9459) Preliminary design of blanket handling device and evaluation of the feasibility of eliminating the spread of radioactive contamination.** Charruyer, P. and others. (Societe Technique pour l'Energie Atomique (TECHNICATOME) Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR); Djerassi, H.; Leger, D.; Maupou, M.). (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1988. 2p. (EN, FR). (CONF-880417—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754930/JAW.

From 1. international symposium on nuclear fusion technology (ISFNT); Tokyo, Japan (10 Apr 1988).

This study makes the synthesis of ongoing works concerning the remote handling device required for the handling of the internals of a fusion reactor like NET, with the double nul configuration. This work follows the analysis of the comparison of vertical versus horizontal maintenance approach.

14024 **(CEA-N—2548(E)) Data and properties of lithium aluminate γ LiAlO/sub 2/.** Denuziere, C.; Roux, N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Jan 1988. 121p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754940/JAW.

In this report are gathered and analysed the literature data until july 1st, 1984, concerning the properties of lithium aluminate γ LiAlO/sub 2/ relevant for the investigation of this compound as a tritum breeding material for a fusion reactor blanket. A french version of this report exists.

14025 **(CNIC—00162) Method for solving X-ray spectra in laser fusion and a research on ponderomotive force.** Liu Chenghai; Lu Zhengqiang; Zhang Jiatai; Chang Tieqiang. (Inst. of Applied Physics and Computational Mathematics., Beijing, BJ (China)). (China Nuclear Information Centre, Beijing, BJ). Jan 1988. 14p. (In Chinese). (IAPCM—0010). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705066/JAW.

Two parts are inclued. (1) A method for solving X-ray spectra in laser fusion is presented. In order to solve X-ray spectra in laser fusion, an iterative method with amplitude-limiting and periodic smoothing technique has been developed on the basis of SAND iteration. It has been used to solve the X-ray spectra in laser fusion and some satisfactory results have been obtained. The method is suitable for solving the X-ray spectra from the data of sub-keV X-ray spectrometer, multi-channel K-edge filtering spectrometer and multi-channel filtering fluorescence spectrometer. The computational results show that the numerical instability is suppressed completely, and nonphysical 'negative spectra' and numerical structure in the computed X-ray spectra are eliminated by means of this method. The computational results are independent of the initial trial spectra. (2) Two-dimensional propagation of laser and ponderomotive force are studied. The authors have also studied the two-dimensional laser propagation code HEATER, which has been used in numerical research on absorption rate and radial and axial ponderomotive force with some proper modifications.

14026 **(CONF-880736—4) Gorter-Mellink heat transport in He-II transverse to tube banks and through ducts of nonuniform cross section.** Dresner, L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005669/JAW.

From 12. international cryogenic engineering conference and exhibition; Southampton, United Kingdom (12 Jul 1988).

Heat transport in the practical range of fluxes ({approximately}1 W/cm²) obeys the nonlinear Gorter-Mellink relation {rvec q} = -K({del}T)/sup 1/3/. In this paper, we study steady-state Gorter- Mellink heat transport through a plane duct of nonuniform cross section and transverse to a bank of parallel tubes with adiabatic surfaces ranged in either a square or triangular lattice. Both problems are solved by the method of complementary variational principles. 5 refs., 2 figs., 1 tab.

14027 **(CONF-8809159—5) Tritium-processing operations at the Oak Ridge National Laboratory with emphasis on safe-handling practices.** Kobisk, E.H.; Ramey, D.W.; Aaron, W.S.; Tompkins, J.A.; Haff, K.W.; DeVore, J.R.; Adair, H.L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 37p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005667/JAW.

From 14. world conference on the International Nuclear Target Development Society; Darmstadt, F.R. Germany (5 Sep 1988).

The ever-increasing world inventory of tritium mandates improvement of handling procedures to prevent accidental releases and/or personnel exposures. Tritium releases to the environment can arise from several sources: tritium production; nuclear weapons testing; natural production by the interaction of cosmic radiation with nitrogen nuclei; reactor operations and nuclear fuel reprocessing; and disposal of consumer products containing tritium. The natural production of tritium by cosmic rays presently accounts for most of the world's inventory of tritium [70 to 140 MCi (2.59 to 5.18 EBq) in 1985]; however, fusion power reactor programs will probably increase tritium inventories by about 100 MCi (3.7 EBq). Uncertain long-term effects to processing personnel or the general population resulting from exposure to tritium in the environment necessitate improvement in tritium production and/or processing procedures to minimize tritium releases. Tremendous progress has been made in the handling of tritium since it was first produced by Luis Alvarez in 1936. At the Oak Ridge National Laboratory (ORNL), considerable improvement in tritium-handling procedures has resulted from developments in the Isotope Program. Specific ORNL programs involving tritium will be described with emphasis on the safe-handling practices as developed and used in these programs. 7 refs., 16 figs., 1 tab.

14028 **(DOE/ER/53244—T3) RFP experiments with thin conducting shells.** Robertson, S.; Schmid, P. (Colorado Univ., Boulder (USA)). Aug 1987. Contract FG02-87ER53244. 12p. NTIS, PC A03/MF A01. Order Number DE88017032/JAW.

The Reversatron RFP has been operated with a thin, segmented aluminium shell having a penetration time for the vertical field of 400 μs. The duration of the discharges is increased from the 220 μs obtained with no shell to 300 μs. The poloidal field fluctua-

tions measured just outside the vacuum liner have nearly twice the amplitude when the thin shell is installed. This is interpreted as being due to image currents in the shell. The shell appears to suppress the growth of global m=1 modes of low toroidal mode number. In a second set of experiments, discharges were investigated in which the toroidal field was maintained at a positive value rather than reversed. These ultra-low-q tokamak discharges show strong dynamo activity and are not significantly more resistive than RFP discharges. 7 refs., 8 figs.

14029 **(DOE/ET/51013—259) A commercial tokamak reactor using super high field superconducting magnets.** Schwartz, J.; Bromberg, L.; Cohn, D.R.; Williams, J.E.C. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). 14 Nov 1988. Contract AC02-78ET51013. 29p. (PFC/CP—88-3; CONF-881031—59). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005920/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

This paper explores the range of possibilities for producing super high fields with advanced superconducting magnets. Obtaining magnetic fields greater than about 18 T at the coil in a large superconducting magnet system will require advances in many areas of magnet technology. These needs are discussed and potential solutions (advanced superconductors, structural materials and design methods) evaluated. A point design for a commercial reactor with magnetic field at the coil of 24 T and fusion power of 1800 MW is presented. Critical issues and parameters for magnet design are identified. 20 refs., 9 figs., 4 tabs.

14030 **(DOE/FTR—9006120) [5th US-Japan workshop on high field superconducting materials for magnetic fusion and site visits in Kobe, Fukuoka, Miyazaki and Tokyo, Japan, November 10--22, 1987]: Foreign trip report.** Suenaga, Masaki. (Brookhaven National Lab., Upton, NY (USA)). 30 Nov 1987. Contract AC02-76CH00016. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006120/JAW.

The main topics which were covered at the Workshop were the results of the Round-Robin Tests for critical currents I/sub c/ of Nb_3Sn wires to identify a preferred method for measurements of I/sub c/; determination of relationship between microstructures and critical current density J/sub c/; and the present status of the oxide superconductors. In general, this workshop has again been very useful for exchange ideas and results among participants from two countries, and some main conclusions from the Workshop are the results from measurements of I/sub c/ of Nb_3Sn wires are still inconsistent and further Round Robin tests are required to select a standard measuring technique; characterization of microstructures has advanced for some practical wires to the extent that a qualitative comparison between experiments and theories for flux pinning is becoming possible; and in spite of enormous excitements which were generated by discovery of the high T/sub c/ superconducting oxides, the values of J/sub c/ in this material have been low. The highlight of this section was the announcement of J/sub c/ $\sim$ 1.1 {times} 10^4 A/cm^2 at 77 K at H = 0 in a short section of a wire of $YBa_2Cu_3O_7$. This value is greater by {approximately}1 to 10 times that what has been previously reported.

14031 **(EGG-M—40087) Hydrogen ion-driven permeation in carbonaceous films.** Anderl, R.A.; Holland, D.F.; Longhurst, G.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 20p. (CONF-880512—18). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005271/JAW.

From 8. international conference on plasma surface interactions in controlled fusion devices; Julich, F.R. Germany (2 May 1988).

This paper presents the results of investigations into the permeation properties of amorphous carbonaceous, a-C:H, films produced by plasmachemical deposition techniques. Carbonaceous films on iron substrates with thickness ranging from 60 nm to 110 nm were subjected to high fluence implantations with mass analyzed D_3^+ ions with energies ranging from 600 eV to 3000 eV and fluxes ranging from 5 {times} 10^{14} D/cm^2-s to 5 {times} 10^{15} D/cm^2-s, respectively. Deuterium re-emission upstream, deuterium permeation downstream and secondary ions sputtered from the implantation surface were measured as a function of implantation fluence for specimens at 420 K. The present studies that the a-C:H film permeability is directly related to the time, hence the fluence, required to achieve isotopic replacement and saturation of the deuterium ion beam atoms stopped in the implant region. Once the deuterium saturation level is achieved in the layer, a significant fraction of the implanting ions can result in permeation. For the present experiment, this permeation factor was much higher than that for uncoated iron specimens subjected to similar beam conditions. Carbon sputter yields of 0.008-0.01 C/D were determined in this work for 1000-eV to 400-eV deuterium ions incident on a-C:H films. 33 refs., 3 figs.

14032 **(EGG-M—88078) Fusion safety and environmental performance goals.** Piet, S.J.; Holland, D.F. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 10p. (CONF-881031—57). NTIS, PC A03 - OSTI. Order Number DE89005413/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The global fusion community is beginning to take the first real technological steps toward the ultimate haven of safe, economic, and environmentally benign commercial fusion power. We cannot see all the details of commercial fusion power at this distance. "Safe" and "clean" will be defined by public acceptance and, hopefully, by a rational licensing system. In this paper, we express fusion safety and environmental goals via performance measures to chart the proper course, especially the first steps to take. These measures cover accident safety, effluent control, and waste management. We should also periodically refine these goals as knowledge grows. 17 refs., 3 figs., 3 tabs.

14033 **(HIFT—147) Computational study of three-dimensional magnetohydrodynamic equilibria in toroidal helical systems, (2).** Hayashi, Takaya; Harafuji, Kenji; Sato, Tetsuya. (Hiroshima Univ. (Japan). Inst. for Fusion Theory). Apr 1988. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756538/JAW.

Computational methods based on the time-dependent relaxation technique for obtaining finite beta stellarator equilibria with no net current are described. Breaking-up of magnetic surfaces due to finite β effect in a low aspect ratio l = 2 torsatron is shown.

14034 **(HIFT—149) Two-dimensional analysis on limiter/divertor transition in scrape-off layer plasmas.** Ueda, N.; Itoh, K.; Itoh, S.-I. (Mitsubishi Atomic Power Industries, Inc., Tokyo (Japan)). (Hiroshima Univ. (Japan). Inst. for Fusion Theory). Apr 1988. 49p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756539/JAW.

Numerical study on the scrape-off layer and divertor plasmas is made by using the global and two-dimensional code. Structure of the SOL and divertor plasma in the Doublet-III open-divertor configuration is discussed. The distance between the plasma surface and limiter is changed, and the interaction of the plasma with limiter as well as the effect of neutrals on the main plasma are discussed. The minimum clearance of the limiter to get rid of the interaction is also obtained. The scalings of the edge temperature and the e-folding length of the SOL plasma on the power are obtained.

14035 **(HIFT—150) Numerical studies on divertor experiments.** Ueda, N.; Itoh, K.; Itoh, S.-I.; Tanaka, M.; Hasegawa, M.; Shoji, T.; Sugihara, M. (Mitsubishi Atomic Power Industries, Inc., Tokyo (Japan)). (Hiroshima Univ. (Japan). Inst. for Fusion Theory). Apr 1988. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756540/JAW.

Numerical analysis on the divertor experiments such as JFT-2M tokamak is made by use of the two-dimensional time-dependent simulation code. The plasma in the scrape-off layer (SOL) and divertor region is solved for the given particle and heat sources from the main plasma, Γ/sub p/ and Q/sub T/. Effect of the direction of the toroidal magnetic field is studied. It is found that the heat flux which is proportional to b vector x nablaT/sub i/ has influences on the divertor plasmas, but has a small effect on the parameters on

the midplane in the framework of the fluid model. Parameter survey on Γ/sub p/ and Q/sub T/ is made. The transient response of the SOL/divertor plasma to the sudden change of Γ/sub p/ and Q/sub T/ is studied. Time delay in the SOL and divertor region is calculated.

14036 **(IAE—4463/8) First wall and divertor plate sputtering in tokamak reactor.** Abramov, V.A.; Igitkhanov, Yu.L.; Pistunovich, V.I.; Pozharov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. 35p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704949/JAW.

Values of spattering coefficient and erosion rate for materials and colliding particles typical conditions of the first wall and divertor plates in tokamak averaged in the energy of colliding particles are obtained. The sputtering coefficient is determined for carbon, aluminium, titanium, iron, molybdenum, vanadium, tungsten sputtered by hydrogen isotopes (hydrogen, deuterium, tritium) and helium atoms (ions). It is shown that account of potential difference between wall and plasma brings about considerable increase of sputtering coefficient. The account of annualar distribution of falling particles proves significant both in the range of high and low temperature. It is shown that tokamak first wall erosion brought about by the sputtering by neutral atoms noticeably increses erosion value obtained with no respect to angular dependence of the sputtering coefficient. 11 refs.; 5 figs.; 30 tabs.

14037 **(IAE—4559/8) Radiation protection of fusion reactor magnets.** Zimin, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1988. 44p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705252/JAW.

The efficiency of heterogeneous radiation protection of thermonuclear reactor (TNR) magnetic coils is estimated within the framework of a one-dimensional model. It depends on the mutual location of light and heavy components. The homogeneous protection and the iron-water protection with the optimum profile of light and heavy component location obtained from sensitivity calculations are also considered. Methodological recommendations for work with programs and constant libraries used in calculations are given. Blanket effect on protection efficiency is considered. 15 refs.; 26 figs.; 3 tabs.

14038 **(INIS-mf—11345) Feasibility study of an experiment for measuring the thermal conductivity of Lithium alluminate, possible breeder for fusion reactors, by irradiation of samples in Casaccia RC-1 reactor.** Verri, A. (ENEA, Casaccia (Italy). Centro Ricerche Energia). (Associazione Termotecnica Italiana, Turin). 1987. 10p. (In Italian). (CONF-8709310—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705274/JAW.

From 42. National Congress of the Italian Thermotechnical Association; Genoa, Italy (8 Sep 1987).

In this paper it is shown that experiments can be carried out in a high-flux reactor, in order to determine the thermal conductivity of Lithium alluminate, at various temperatures.

14039 (IPPJ—863, pp 77-88) **TRIPIC: triangular-mesh particle-in-cell code for LIB diode.** Kawata, Shigeo; Matsumoto, Masami; Masubuchi, Yukio. (Technological Univ. of Nagaoka, Niigata (Japan)). Mar 1988. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780049/JAW. (CONF-8703311—).

From 2. U.S.-Japan workshop on advanced plasma modeling; Nagoya, Japan (23 Mar 1987).

A particle-in-cell code using triangular meshes (TRIPIC code) is described to simulate the motion of charged particle in an electromagnetic field self-consistenly in some complicated computational space region. TRIPIC is fitted for the simulation of LIB (Light Ion Beam) diode, for example.

14040 **(IPPJ—880) Development of the work function monitoring method for a converter of a negative ion source.** Yamaoka, Hitoshi; Sasao, Mamiko; Wada, Motoi; Ramos, H.J. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jul 1988. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756551/JAW.

A method to monitor the change in the work function of the converter surface in a self-extraction negative ion source is developed. The photoelectron emission from the Cs-Mo surface in a plasma is detected by irradiating surface with laser lights. Negative ions produced at the surface shows a strong correlation with the photoelectron current from the surface in hydrogen and helium discharges. The photoelectron current induced by the Ar/sup +/ laser is used to detect the change in the cesium coverage, or the work function, while that by the dye laser is found to be suitable to confirm the region of the work function minimum.

14041 **(IPPJ—882) Effect of double-shell structure on reduction of field errors in the STP-3(M) reversed-field pinch.** Yamada, S.; Masamune, S.; Nagata, A.; Arimoto, H.; Oshiyama, H.; Sato, K.I. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Aug 1988. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756553/JAW.

Reversed-field pinch (RFP) operation on STP-3 (M) proved that the adition of a quasistational vertical field B sub(perpendicular) together with large reduction of irregular magnetic field at the shell gap could remarkably improve properties of the plasma confinement. Here, the gaps of a thick shell is wholely covered with the single primary coil having a shell shape. The measured field error at the gap is as small as 7.5 % of the poloidal field. The application of B sub(perpendicular) sets the plasma at a more perfect equilibrium. In this operation, the plasma resistivety much decreased by a factor 2 and the electron temperature rose up to 0.8 keV.

14042 **(IPPJ-DT—139) Thermal gas desorption of various candidates for plasma facing materials.** Kubota, Yusuke; Miyahara, Akira. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jun 1988. 50p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756555/JAW.

Degassing property of different kinds of graphites and carbons, which are candidates for fusion reactor wall materials, has been investigated by using a thermal desorption spectrometer(TDS). The test samples are heated up to 1400 deg C in TDS, and desorbed gas amounts and gas compositions are measured. From the measurements effects of size and pretreatment for every test samples and readsorption property for samples after degassing are made clear. To perform accurate and quick measurements of outgas data for test samples, a data processor using a 16 bit personal computor has been developed and used. The fabrication of TDS and the data processor, many outgas data and error estimation for the data are described in this paper.

14043 **(JAERI-M—88-153) Dependence of coupling resistance on toroidal wave number spectrum during H-mode discharge.** Saigusa, Mikio; Kimura, Haruyuki; Fujii, Tsuneyuki; Kobayashi, Noriyuki; Moriyama, Shin-ichi; Annoh, Katsuto; Ogawa, Yoshirou; Shinozaki, Shin-ichi; Terakado, Masayuki. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756562/JAW.

The increase in coupling resistance of ICRF antenna during H-mode discharges is firstly investigated in JT-60. This interesting phenomena which were depended on K sub(parallel) spectrum can be explained with the antenna-plasma coupling theory taking account of the antenna phasing and the electron density profiles. It became evident that the coupling resistance can be kept constant after H-mode transition by the optimum antenna design and the property control of antenna phasing. But the decrease in coupling resistance during H-mode discharge is predicted on the toroidal 4 loop antenna array designed for JT-60U ICRF launcher in high density regime.

14044 (JAERI-M—88-171) **Steady-state operation regime of tokamak reactor plasma. Consistency analysis (I).** Itoh, Kimitaka; Fukuyama, Atsushi; Itoh, Sanae; Takizuka, Tomonori; Yamamoto, Shin; Matsuda, Shinzaburo. (Kyoto Univ., Uji (Japan). Plasma Physics Lab.). (Japan Atomic Energy Research Inst., Tokyo). Sep 1988. 36p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756571/JAW.

Consistency of physics constraints imposed on a core plasma in a tokamak reactor is investigated. Conditions for the stationary operation of the ITER-grade plasma are listed, i.e., density limit, critical-β, feasibilities of full current-drive and divertor functioning, and so on. The parameter regime, in which these guide lines are simultaneously satisfied, is searched for. Based on the present data base, we examine the consistency of conditions. The L-mode scaling is employed for the extrapolation. The Q-value and the size dependence are studied. The consistent working region of the stationary operation is found. If the offset-linear scaling is applied, the minimum and necessary input power is around 130 MW, which enables the full current-drive and stationary operation with I/sub p/ = 20 MA. When the input power is increased up to 200 MW, the Q-value of 5 can be possible.

14045 (JINR—D-14-87-799, pp 208-216) **Muon catalyzed DT fusion at low temperature.** Crowe, K.M. (California Univ., Berkeley (USA)). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The purpose of the work is to provide additional experimental data on muon-catalyzed fusion using a new target. The target is specifically made for studying the cycle rate variations with density near the solid liquid interface. In addition the rates in nonequilibrated mixtures, and a few gas phase density points are considered. The protonium effects are studied and the nitrogen impurity effect is verified. The conclusion is made that the obtained results confirm basically the picture about the DT kinetics and sticking probability evaluated from the previous experiments. Ran sticking from the data with larger cycle rates (taken in solid phase or in nonequilibrated mixtures) are somewhat smaller, which is mainly due to smaller contributions from the tμt channel. 8 refs.; 4 figs.

14046 (JINR—D-14-87-799, pp 235-245) **X-ray studies on muon-catalyzed fusion with pulsed muons.** Nagamine, K.; Matsuzaki, T.; Isnhida, K. 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

X-ray studies on muon-catalyzed fusion with pulsed muons are reviewed. The muonic X-ray observation method is used to determine the μ-α sticking probability from the μ/sup 4/He atom. The sticking probability for the X-ray method ω/sub s/ (X) (below 0,36%) is smaller than that for the neutron method ω/sub s/(n) (0.46+-0.07%). The experimentally obtained ω/sub s/(X) is far smaller than any of the theoretical predictions. 12 refs.; 2 figs.

14047 (JINR—D-14-87-799, pp 246-259) **Sticking and stripping in muon-catalyzed fusion.** Markushin, V.E. (AN SSSR, Moscow. Fizicheskij Inst.). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

The report concerns the following aspects: the initial muon sticking in dtμ, ddμ, ttμ, pdμ and ptμ mesic molecules, the muonic helium kinetics and the intensities of muonic X-ray transitions following the muon-catalyzed reactions (μCR). The main attention is paid to the new theoretical results obtained after 1986 and to the combined analysis of the experimental information regarding various mesic molecules. 37 refs.; 4 figs.

14048 (JINR—D-14-87-799, pp 260-267) **Gamma-ray measurements in muon-catalyzed fusion.** Hartmann, F.J.; Bossy, H.; Daniel, H. and others. (6134633DE). 1987. NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Gamma-ray measurements in muon-catalyzed fusion are reported on. Two types of fusion processes between hydrogen isotopes pμd -> /sup 3/He+μ+γ+5.5 MeV, pμt -> /sup 4/He+γ+5.5 MeV and pμt -> /sup 4/He+μ+γ+19.8 MeV, pμt -> μ/sup 4/He+γ+19.8 MeV are investigated to extract molecular formation and fusion rates in protium-deuterium mixtures. Furthermore pt fusion is a good example for the interplay between muonic-molecular and nuclear properties. Different kinds of fusion processes depending on the orientation of muon and nuclear spins in the pμt molecule are explained in detail. 14 refs.; 4 figs.

14049 (JINR—D-14-87-799, pp 337-340) **Mesoatomic charge-exchange processes in helium-containing mixtures.** Popov, N.P. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Processes of mesic atom recharging in helium-containing mixtures are studied. It is shown that direct mesic hydrogen recharging in a basic state on H/sub μ/+He -> He/sub μ/+H helium nuclei is suppressed due to the absence of pseudointerlacing of molecular terms corresponding to initial and final reaction states. At the same time molecular H/sub μ/+He -> H/sub μ/He/sub μ/+H+γ recharging accompanied by gamma-radiation with {similar←to} 7 keV energy at the rate exceeding the first reaction one by two orders, is possible. When evaluating muon losses as a result of muon interception by helium one should take into account not only the interception from mesonic atom in a basic state but during mesic hydrogen de-excitation as well. 15 refs.

14050 (JINR—D-14-87-799, pp 341-343) **Charge exchange in excited mesic hydrogen in metastable 2s -state on helium nuclei.** Kravtsov, A.V.; Mikhajlov, A.I.; Popov, N.P. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Mechanisms of excited mesic hydrogen recharging in a metastable 2s-state on /sup 3/He, /sup 4/He helium nuclei are considered. Binding energies of pμ/sup 3/He, pμ/sup 4/He, dμHe, dμ/sup 4/He, t/sub μ//sup 3/He, tμ/sup 4/He mesic molecules calculated in the present work and the rates of their production in (H/sub μ/)/sub 2s/*+He -> ((H/sub μ/)/sub 2s/*He/sup 2+/e)/sup +/+e and (H/sub μ/)/sub 2s/*+He -> ((H/sub μ/)/sub 2s/*He/sup 2+/2e)* reactions in contrast to results of other works indicate a possibility of mesic molecule resonance production. 11 refs.

14051 (JINR—D-14-87-799, pp 344-346) **Charge-exchange of mesic hydrogen in lithium.** Kravtsov, A.V.; Mikhajlov, A.I.; Popov, N.P. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Mechanisms of mesic hydrogen recharging in lithium are investigated. Binding energies of hydrogen-lithium mesic molecules pμ/sup 6/Li, pμ/sup 7/Li, dμ/sup 7/Li, tμ/sup 6/Li, tμ/sup 7/Li7.4,8.20, 13.5, 14.7, 16.9, 18.3 are calculated. The rates of hydrogen-lithium mesic molecule formation are calculated (10/sup 6/ c/sup -1/). The calculations have shown that the rates of mesic hydrogen molecular recharging on lithium nuclei depend sufficiently on the character of lithium electron shell description and 2s electron conversion mechanism. 7 refs.

14052 (JINR—D-14-87-799, pp 317-336) **Conceptional layout of the hybrid muon-catalyzed fusion reactor.** Petrov, Yu.V. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780035/JAW. (CONF-8706161—).

From 2. international conference on muon and pion interactions in matter; Dubna, USSR (30 Jun 1987).

Results of preliminary engineering and calculation of separate units of a hybrid muon-catalysed reactor based on applying fast neutrons of synthesis in the uranium blanket for the main /sup 238/ U isotope fission and plutonium and tritium breeding, are presented. Design and efficiency of single units as pion-generating target, converter, synthesizer and blanket are considered. Problems of heat removal and hydrogen purification of helium are discussed. Hybrid muon-catalysed reactor cost economic limitations are evaluated. It is shown that the reactor considered consumes almost all the power generated and produces plutonium for more than 4 thermal nuclear reactors. So that this reactor might efficiently compete with fast reactors, its cost should not exceed that of a normal light-water cooled reactor two times. Combination of muon-catalysed and electro-nuclear ways of fuel producing in a single unit increases the power efficiency 1.5 times as compared to the purely electro-nuclear one. As compared to the hybrid thermonuclear reactor, the power balance in the muon-catalysed reactor is more stressed but it seems to be more simple and reliable from the structural viewpoint. 55 refs.; 3 figs.; 4 tabs.

14053 **(Juel—2207) Wall conditioning of fusion devices by reactive plasmas.** Winter, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Plasmaphysik; Duesseldorf Univ. (Germany, F.R.)). Jun 1988. 167p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756510/JAW.

Conditioning of the plasma facing components of fusion devices like inner wall surfaces and limiters is a necessary prerequisite for the obtention of pure and stable fusion plasmas. Radiofrequency assisted dc-glow discharges in various gases (hydrogen, oxygen, methane) are a flexible tool to produce reactive species, which deplete the wall surfaces from reducible oxygen - and carbon compounds, or allow to plasmachemically deposite well defined thin layers onto them. The carbonization technique, i.e. the in situ deposition of amorphous hydrogenated carbon layers (a-C:H) and the resulting effects on tokamak plasmas are discussed in detail. Its application leads to significantly improved plasma performance. After its development and characterization at the Juelich tokamak TEXTOR it is now being used worldwide.

14054 **(LA-UR—88-3326) Uniform ribbon-beam generation for accelerator production of tritium.** Jason, A.J.; Blind, B.; Svaton, E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-881049—64). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005443/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

A scheme has been developed to produce a uniform distribution of beam energy over the large target of a tritium production facility. A highly expanded ribbon beam is produced by an astigmatic lens system that contains strong octupole and duodecapole elements. The nonlinear focusing of these elements gives rise to a nearly uniform distribution of intensity along most of the ribbon length. Sweeping the beam orthogonal to the ribbon then provides a simplified alternative of two-dimensional raster schemes. Additionally, the scheme virtually eliminates the beam fringes by deflecting fringe particles into the beam core. This scheme reduces transport line activation and allows a decreased element size. The technique can be used in other applications that require a uniform intensity distribution in one dimension. Further work is continuing on producing an analogously two-dimensionally uniform beam. 3 refs., 4 figs., 1 tab.

14055 **(PNL-SA—15855) Assessment of stress-corrosion cracking for near-term fusion reactors.** Jones, R.H. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1988. Contract AC06-76RL01830. 5p. NTIS, PC A02 - OSTI. Order Number DE89005533/JAW.

Water-cooled, near-term fusion reactors will operate under conditions at which stress-corrosion cracking (SCC) is possible; however, control of material purity and fabrication procedures can reduce the probability of crack initiation and growth. Some of the critical issues identified in this evaluation are: will irradiation-assisted stress-corrosion cracking (IASCC) occur at temperatures lower than 100{degree}C, and if so, is the neutron fluence threshold equal to or less than near-term reactor fluences? will aqueous-salt solutions cause SCC? and will radiolysis accelerate SCC in clean water or aqueous-salt coolants? 21 refs., 3 figs.

14056 **(SAND—87-3051C) Collector probe measurements of OHMIC conditioning discharges in TFTR.** Kilpatrick, S.J.; Dylla, H.F.; Wampler, W.R.; Manos, D.M.; Cohen, S.A.; Bastasz, R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789;AC02-76CH03073. 20p. (CONF-880512—19). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005640/JAW.

From 8. international conference on plasma surface interactions in controlled fusion devices; Julich, F.R. Germany (2 May 1988).

Special limiter conditioning techniques using low density deuterium or helium discharges have produced enhanced plasma confinement in TFTR. Measurements with a rotatable collector probe have been made to increase our understanding of the boundary layer during these conditioning sequences. A set of silicon films behind slits facing in the ion and electron drift directions was exposed to four different D^+ and He^{++} discharge sequences. The amounts of deuterium and impurities trapped in the surface regions of the samples have been measured by different analytical techniques, including nuclear reaction analysis for retained deuterium, Rutherford backscattering spectroscopy for carbon and metals, and Auger electron spectroscopy for carbon, oxygen and metals. Up to 1.9 {times} 10^{17}cm/sup {minus}2/ of deuterium was detected in codeposited carbon layers with D/C generally in the range of the bulk saturation limit. Radial profiles and ion drift/electron drift asymmetries are discussed. 22 refs., 3 figs., 1 tab.

14057 **(SAND—88-1208C) Tritium retention and conditioning of graphite limiters in TFTR.** Ulrickson, M.; Bell, M.G.; Budny, R.; Bush, C.E.; Dylla, H.F.; Ehrhardt, A.B.; Gilbert, J.; Goldston, R.; Griesbach, O.; Hawryluk, R.J. (Sandia National Labs., Albuquerque, NM (USA); International Atomic Energy Agency, Vienna (Austria)). 1988. Contract AC02-76CH03073;AC04-76DP00789. 13p. (IAEA-CN—50/G-3; CONF-881015—37). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005916/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

The attainment of high confinement auxiliary heated plasmas in TFTR requires careful conditioning of the graphite limiters. In addition to the usual techniques of glow discharge and pulse discharge cleaning, we have found it necessary to use multiple low density ohmic discharges to thoroughly degas the limiter. Further conditioning is achieved by high power auxiliary-heated plasmas. The result of the conditioning is a limiter with low recycling ($R \approx 0.5$) and a large capacity to pump hydrogenic atoms. Limiter conditioning has also been found to assist hydrogen isotope exchange. The retention of hydrogen isotopes in the limiter has been studied. Our present estimates of the retention yield an in-vessel tritium inventory of 1.8 - 3.0 g after the equivalent D-T fueling of 600 full-power plasmas. 13 refs., 4 figs., 1 tab.

14058 **(SAND—88-1434C) Hydrogen isotope trapping on graphite collectors during an isotope exchange experiment in the tokomak fusion test reactor.** Kilpatrick, S.J.; Nygren, R.; Wampler, W.R.; Ulrickson, M.; Dylla, H.F.; Manos, D.M.; Ramsey, A.T.; Hirooka, Y. (Sandia National Labs., Albuquerque, NM (USA); Princeton Univ., NJ (USA). Plasma Physics Lab.). 1988. Contract AC04-76DP00789;AC02-76CH03073. 17p. (CONF-881002—43). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005601/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

A rotatable collector probe was used to expose several graphite samples to a deuterium-to-hydrogen-to-deuterium exchange experiment in the Tokamak Fusion Test Reactor (TFTR) at the start of the 1988 operations period. This experiment proved the utility of helium conditioning discharges in accelerating the changeover process. Samples included portions of a tile taken from the inner bumper limiter (POCO AXF-5Q graphite) of TFTR during the recent machine opening, and coupons which had been conditioned in the Plasma Surface Interaction Experimental Facility (PISCES) by exposure to a helium plasma. The samples were exposed to different groups of the {approximately}100 1.4MA discharges that comprised the experiment. They were removed and analyzed for retained deuterium and impurities by nuclear reaction analysis and Rutherford backscattering spectrometry. Codeposited carbon layers had been formed with thicknesses up to several tenths of a micron. The inferred percentages of trapped hydrogenic species were in general agreement with spectroscopic data. The computed carbon fluence per D^+ discharge, 1.2 {times} 10^{17} C/cm^2, is compared to recent measurements on limiter tiles removed from TFTR. 21 refs., 3 figs., 1 tab.

14059 **(SAND—89-0038C) Heat removal considerations in a tokamak pump limiter design.** Roy, R.P.; Koski, J.A.; Whitley, J.B. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 7p. (CONF-881120—21). NTIS, PC A02 - OSTI. Order Number DE89005778/JAW.

From ASME winter annual meeting; Chicago, IL, USA (28 Nov 1988).

In experimental fusion energy devices such as tokamaks, pump limiters are used to define the plasma edge as well as control the plasma density and impurity. Since these devices must operate at the edge of the plasma, they are subject to high heat flux incidence from the plasma side. In this paper, one of the active heat removal schemes considered for the outboard pump limiter of Tore Supra, a tokamak under construction in Cadarache, France, is analyzed in some detail. The scheme involves cooling by forced convective nucleate boiling of water at the limiter leading edges and by forced convection of high pressure helium at its front face. 14 refs., 5 figs., 4 tabs.

14060 **Spectroscopic study using line ratios of lithiumlike ions in a laser-produced plasma.** Moreno, J.C.; Goldsmith, S.; Griem, H.R. (Laboratory for Plasma Research, University of Maryland, College Park, Maryland 20742). *Journal of Applied Physics;* **65**: No. 4, 1460-1464(15 Feb 1989).

Spectra of highly ionized titanium and calcium in the extreme ultraviolet region were observed in laser-produced plasmas using the OMEGA 24 beam (351 nm) laser system at the University of Rochester. The plasmas were produced using glass microballoon targets coated with a layer of a medium Z element and a layer of parylene (CH). Time-integrated electron temperatures and densities were obtained by comparing measured line intensity ratios of lithiumlike charge states of Ti and Ca to numerical calculations from a collisional-radiative model. The variation of line intensity ratios with electron density and temperature using the collisional-radiative model is discussed.

14061 **Constitutive model for strain rates from 10^{-4} to 10^{6} s^{-1}.** Steinberg, D.J.; Lund, C.M. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, California 94550). *Journal of Applied Physics;* **65**: No. 4, 1528-1533(15 Feb 1989).

We have developed an addition to the Steinberg--Guinan high strain-rate constitutive model that extends its validity to strain rates as low as 10^{-4} s^{-1}. With this new model, we have successfully reproduced a number of rate-dependent, shock-induced phenomena in tantalum, such as precursor on reshock, precursor decay, and shock smearing. We have also successfully calculated a plate-impact experiment at a loading stress of 230 GPa as well as extensive data for yield strength versus strain rate at room temperature and yield strength versus temperature at a strain rate of 10^{-4} s^{-1}.

99 GENERAL AND MISCELLANEOUS

REFER ALSO TO CITATION(S) 14121

14062 **(DOE/IG—0263) Audit of Lawrence Livermore National Laboratory orders for memorabilia.** (USDOE Office of Inspector General, Albuquerque, NM. Western Regional Office). 23 Dec 1988. 9p. OSTI, PO Bx 62, Oak Ridge, TN 37831- OSTI. Order Number TI89005723/JAW.

We reviewed selected aspects of orders placed by Lawrence Livermore National Laboratory, a Department of Energy contractor, during 1979--1985 for memorabilia, models, and illustrations and the oversight of those orders by the San Francisco Operations Office (SAN). This review extends earlier audit work at a second Department contractor, Rockwell International, Rocky Flats Plant, Engineering Prototype Group, on which we issued a report dated July 12, 1988. That audit focused on the Prototype Group's providing Livermore with illustrations, models, engineering prototypes, and other articles (mementos, plaques, etc.) during October 1977 through September 1985. Issues arose during that audit which required a separate review at SAN and Livermore, to determine specifically: the propriety of, and SAN oversight of, procurement practices followed by Livermore; the basis for the Livermore orders; the adequacy of reimbursement to the Department for silver used in medallions; and the cost ceilings for memorabilia contained in the Department's contract with the University of California, which operates Livermore for the Department. Limiting the audit scope to the orders Livermore placed with Rockwell's Prototype Group, we reviewed Department and Livermore procedures for acquiring memorabilia. In addition to interviewing SAN and Livermore Legal Counsel, Special Material Office personnel, and Research and Development Program representatives, we examined SMO requisitions, accounts payable listings and related payments, and selected research and development correspondences.

14063 **(INIS-mf—11344) Activities of ENEA in 1985-1986. A report of the President.** Colombo, U. (ENEA Neutron Data Compilation Centre, Gif-sur-Yvette (France)). (ENEA, Rome (Italy)). 1987. 398p. (In Italian). NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS. Order Number DE88705273/JAW.

Activities of ENEA in the years 1985 and 1986 are described in detail, specifying the results obtained in all the centers. In addition, the operational structure of ENEA and its budget are also mentioned.

14064 **(LA-UR—88-4248) Expanding the role of the cost engineer.** Stutz, R.A.; Shaw, R.F. (Los Alamos National Lab., NM (USA)). 1989. Contract W-7405-ENG-36. 12p. (CONF-890254—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005478/JAW.

From American Association of Cost Engineers meeting; San Diego, CA, USA (1 Feb 1989).

There have been many questions about the costs of providing medical services. These questions have resulted in the development of Resource-Based Relative Values Scale (RBRVS) at the national level. Policymakers view RBRVS as a potential tool to pay physicians. The questions, about the cost of operations of HSE-2 at Los Alamos National Laboratory, revolve around doing routine occupation health physicals for the Laboratory. Generally, these questions are concerned about why the costs appear to be high relative to what private physician suggests the costs should be. There is also an interest in trying to find methods to reduce these costs if possible. Many of the tools developed to help in construction estimating can be applied to estimating medical costs. With the need to perform many thousands of physicals each year the saving of even a few dollars for each exam can quickly add up to a large saving. There are a number of different types of physicals and different levels; based on age, sex, type of work, and years since last physical. The LANL Health Services are housed in a 12,600 square foot building close to the population center of the Laboratory Health Services, produced by a staff of seven physicians and approximately 25 support personnel, include acute medical care, routine surveillance exams, and preventive medicine programs. This paper will

consider the routine surveillance exams, which constitute the major activity of the medical staff, in terms of time and dollars expended.

14065 **(LLNL—9005947) Some thoughts on FRG views/ outlook as of August 1988 visit.** Gustavson, M.R. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 2p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005947/JAW.

Early in August M.R. Gustavson had an opportunity to meet with a number of individuals in the Federal Republic of Germany to discuss national security issues. He also talked with Paul Zinner, who has spent much of this summer there conducting interviews. The attachment summarizes some of the national security views which were encountered. Recounted here are only those views which have a substantial number of backers and which may be of particular interest to others at LLNL and within DOE.

14066 **(MLM—3550) Stable isotope sales: Mound customer and shipment summaries, FY 1987.** Flayler, K.A. (comp.). (EG and G Mound Applied Technologies, Miamisburg, OH (USA)). 19 Dec 1988. Contract AC04-88DP43495. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005975/JAW.

This report lists Mound's sales of stable isotopes of noble gases, carbon, oxygen, nitrogen, chlorine, bromine, and sulfur for fiscal year 1987. Purchasers are listed alphabetically and are divided into domestic and foreign groups. Cross-reference indexes by location and by isotope purchased are included for all customers. 2 tabs.

9901 Management

REFER ALSO TO CITATION(S) 12853, 13010, 14119

14067 **(CNEA-AC—8/87) Manual of practical works for the course of methodology and application of radioisotopes.** Signoretta de Barbaro, Catalina. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Gerencia de Aplicaciones). (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1987. 126p. (In Spanish). NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88705316/JAW.

This manual used in the Radioisotope Course of the Argentine National Atomic Energy Commission for medical doctors, chemists, biochemists and technicians in chemistry, gives the basis to perform the different specialities. The following 22 works are developed, 1: Preparation of solutions and radioactive samples; 2: Charged particles detection with Geiger Muller counters; 3: Geometry, efficiency; 4: Standardization of measurements; 5: Statistics; 6: Detection and measurement of electromagnetic radiation; 7: photopeak's observation of a gamma spectra at different voltages; 8: Spectrum calibration; 9: Mixtures resolution; 10: Influence of ambient over a spectrum; 11: Solid scintillation detector; 12: Maximum measurable activity without coincidence error; 13: Well-pipe INa-Tl crystal detector; 14: Pulse integrators; 15: Liquid scintillators; 16: Radiochromatography; 17 and 18: Scintiscanning; 19: Typical curve of a Geiger Muller-Tube; 20: Identification of a radioactive sample; 21: Dilution analysis; 22: Quality control of the activity meters. (M.E.L.).

14068 **(CNIC—00202) China nuclear science and technology reports. Abstracts.** (China Nuclear Information Centre, Beijing, BJ). 1987. 77p. (In Chinese). NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705070/JAW.

114 abstracts of nuclear science and technology reports, which were published in 1986-1987 in China, are collected. The subjects inclucled are: nuclear physics, nuclear medicine, radiochemistry, isotopes and their applications, reactors and nuclear power plants, radioactive protection, nuclear instruments etc... They are arranged in accordance with the INIS subject categories, and a report number index is annexed.

14069 **(CONF-890214—1) Considering productivity improvement as a strategy to enhance competitiveness.** Payne, T.L. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE88015295/JAW.

From 2. annual productivity improvement conference; Miami, FL, USA (15 Feb 1989).

Productivity improvement is a commonly utilized strategy which is focused at a historically exploited competitive weapon - price. The value of productivity improvements is based upon reductions in the unit cost of a product. As a strategy to enhance competitiveness, productivity improvement involves the following six-steps: Need Determination, Goal Establishment, Alternatives Definition, Productivity Improvement Mechanism Selection, Implementation, and Monitoring Impact and Control. This paper shall address each of the six steps involved in productivity improvement strategies. The productivity improvement model developed by this paper shall be useful to all organizations desiring to gain insight to the productivity improvement process. 2 figs.

14070 **(DOE/MA—0349) DOE real property: A yearly statistical handbook.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of Project and Facilities Management). Dec 1988. 85p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005938/JAW.

The purpose of the annual statistical handbook is to be used as a service to DOE officials and others, who need to reference DOE real property data as part of their daily functions. It is comprised of 3 sections: land holdings, buildings, and other structures and facilities. Each section includes tables and graphs to help illustrate the data precisely and clearly. The information provided by the handbook is comprehensive and up to date. (TC)

14071 **(DOE/MA—0352) Annual report to Congress on competition in contracting, FY 1988.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Agency Competition Advocate). 1988. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006394/JAW.

This report provides an overview of DOE's organizational structure and contracting activities that support the Department's various technological and production missions. DOE's mission includes basic and applied research in such areas as nuclear, solar, geothermal, and fossil energy; civilian and defense radioactive waste management; and conservation programs. The Department also supports national defense/national security efforts through the development and production of nuclear weapons and naval reactors, and through the management of petroleum and oil shale reserves. Additionally, the Department manages and operates five power administrations that sell and distribute electric power in various regions of the United States. This report also includes a description of the contracting arrangement used when contracting for the management and operation of the DOE's national laboratories, defense related, and other facilities.

14072 **(IA—1440) Research laboratories annual report 1987.** (Israel Atomic Energy Commission, Tel Aviv). Aug 1988. 396p. NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS. Order Number DE88705322/JAW.

The 1987 report reflects a continuation of trends and patterns established in previous years. It does not reveal novel revolutionary developments and does not open new horizons and vistas. Rather, the report represents what we believe is a sound and mature program striving to achieve a proper balance between innovative basic research and economically viable practical applications. In the field of nuclear power, six entries are devoted to an analysis of the economics, safety and vulnerability of HTGR's. Theoretical work on more advanced concepts of hybrid and fusion reactors, is also a part of our research program. In plasma physics, the highly innovative applied topic of electrothermal propulsion was added to the more familiar research on laser induced plasmas and use of cool, low density plasmas to produce coatings and other thin layers of refractory materials. Results from the airborne radiometric survey carried out in collaboration with the Geological Survey of

Israel and some of the techniques developed for this purpose are shown here for the first time. Of particular interest are the anomalies found in the Gevanim Valley in the Machtesh Ramon area and their interpretation. Noteworthy achievements in radiopharmaceutics include the development of a new improved /sup 99/Mo//sup 99m/Tc generator and successful clinical tests of the innovative generator of ultrashort-lived /sup 191m/Ir. The food irradiation program has reached the stage of true commercial implementation: over 50 tons of spices and condiments were treated for the food industry in 1987. In the field of non-nuclear applications, important achievements were attained in the development of surgical holmium solid state lasers and their application to gastroenterology, cardiac and vascular surgery, urology, neurosurgery and other disciplines.

14073 **(INIS-XN—146) NEA Activities in 1987.** (Nuclear Energy Agency, 75 - Paris (France)). 1988. 46p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705197/JAW.

This report presents the main features of the Agency work during 1987. It deals with trends in nuclear power. Nuclear development and the fuel cycle; nuclear safety and licensing; radiation protection; radioactive waste management; legal affairs; nuclear science; joint undertakings and other NEA joint projects; information programmes; organization and administration.

14074 **(ORAU—88/H-120) Continuing education for radiation protection instructors: Report on a TRADE [Training Resources and Data Exchange] sponsored course.** (Oak Ridge Associated Universities, Inc., TN (USA)). Sep 1988. Contract AC05-76OR00033. 22p. NTIS, PC A03/MF A01 - OSTI; GPO Dep. Order Number DE89005588/JAW.

The purpose of the TRADE Continuing Education for Radiation Protection Instructors course is designed and presented to update the technical knowledge and skills of instructors who provide radiation protection (RP) training in DOE facilities. This course is supported by the Office of Safety Compliance, DOE, and delivered by Oak Ridge Associated Universities' Professional Training Program.

14075 **(ORAU—88/J-53) Employee assistance programs at Department of Energy contractor facilities: A resources guide.** Perkins, M.; Rabinowitz, L. (Oak Ridge Associated Universities, Inc., TN (USA)). Oct 1988. Contract AC05-76OR00033. 107p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005587/JAW.

The purpose of this guide is to assist DOE contractor personnel, who are responsible for establishing and maintaining their company's employee assistance programs (EAPs), to carry out their duties in identifying and helping employees' personal problems. This guide contains a brief overview, contractor information, an alphabetical listing of contractors, a listing of resources, professional organizations and periodicals, and an annotated bibliography of books, articles, and reports about various EAPs topics areas. (TC)

14076 **(ORAU—88/K-150) TRADE [Training Resources and Data Exchange]: Annual report, FY 88.** (Oak Ridge Associated Universities, Inc., TN (USA)). Nov 1988. Contract AC05-76OR00033. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005590/JAW.

The purpose of this TRADE (The Training Resources and Data Exchange) Annual Report is to provide those personnel involved in training activities across DOE systems with brief descriptions of activities completed through TRADE in FY 1988 and to identify the people who helped accomplish them. The annual report will also provide the DOE offices and contractor personnel with feedback they need to determine how ORAU can best meet current and future training needs. (TC)

14077 **(RCNP-P—99) Collection of reports on use of computation fund utilized in common in 1987.** (Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics). Jun 1988. 169p. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756578/JAW.

In order to support the computation related to the activities of the Research Center for Nuclear Physics, Osaka University, it set up the computation fund utilized in common in 1976. When this computation fund is used, it is decided to present two reports after the finish of its use: the simple report in a definite form, which is published in the RCNP-Z together with the report of the committee on computation fund utilized in common, and the more detailed report concerning the contents of computation, in which the abstract in English, the results obtained by computation and the explanation of the physical contents, the newly developed points, difficulties and method of their solution in computation techniques, the names of Subroutines and Functions used for computation, their functions and block diagrams and so on are described. This book is the collection of the latter reports on the use of the computation fund utilized in common in fiscal year 1987. The public invitation to the computation fund utilized in common is informed by RCNP-Z around December, every year. As to the unclear points, inquire at the Theory Division, the Research Center for Nuclear Physics. (Kako, I.).

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 12762, 13473, 14117

14078 **(AD-A—199625/5/XAB) Parallel algorithms for PDE solvers. Final report, October 1984-February 1988.** Rice, J.R. (Purdue Univ., Lafayette, IN (USA). Dept. of Computer Science). 15 Jul 1988. 5p. NTIS, PC A02/MF A01.

This report lists all of the 39 scientific publications, theses, technical reports, and conference presentations supported by the grant AFOSR 84-0385. The principal focus of the results are in 1) The Collocation Method: New versions developed for parallel machines, new results on the convergence and new software were developed, 2) Mapping Algorithms on to Parallel Machines. Fast heuristic algorithms were found, analyzed, and tested, and a prototype system for automatically mapping PDE algorithms on to parallel architectures were developed.

14079 **(AD-A—199824/4/XAB) Northeast Artificial Intelligence Consortium annual report 1986. Volume 5. Building an intelligent assistant: the acquisition, integration, and maintenance of complex distributed tasks. Interim technical report, January-December 1986.** Lesser, V.; Croft, W.B.; Woolf, B. (Syracuse Univ., NY (USA)). Jun 1988. 295p. NTIS, PC A13/MF A01.

See also Volume 6, Part A, AD-A198 285.

The Northeast Artificial Intelligence Consortium (NAIC) was created by the Air Force Systems Command, Rome Air Development Center, and the Office of Scientific Research. Its purpose is to conduct pertinent research in artificial intelligence and to perform activities ancillary to this research. Progress made in the second year of the existence of the NAIC on the technical research tasks undertaken at the member universities is described. The topics covered in general are: versatile expert system for equipment maintenance, distributed AI for communications-system control, automatic photo interpretation, time-oriented problem solving, speech-understanding systems, knowledge-base maintenance, hardware architectures for very large systems, knowledge-based reasoning and planning, and a knowledge acquisition, assistance, and explanation system. The specific topic for this volume is the development of intelligent interfaces to support cooperating computer users in their interactions with a computer.

14080 **(AD-A—200096/6/XAB) Machine learning of parameter control doctrine for sensor and communication systems. Final report.** Kamen, R.B.; Dillard, R.A. (Naval Ocean Systems Center, San Diego, CA (USA)). Jul 1988. 115p. (NOSC/TR—1220). NTIS, PC A06/MF A01.

Artificial-intelligence approaches to learning were reviewed for their potential contributions to the construction of a system to learn parameter-control doctrine. Separate learning tasks were isolated and several levels of related problems were distinguished. Formulas for providing the learning system with measures of its performance were derived for four kinds of targets.

14081 **(AD-A—200313/5/XAB) Society of Mind project. Final report.** Minsky, M. (Massachusetts Inst. of Tech., Cambridge (USA). Artificial Intelligence Lab.). Aug 1988. 21p. NTIS, PC A03/MF A01.

This project was concerned with developing a theory of intelligent thinking and learning, based on the Society of Mind model of intelligence. The research was funded over a period of years by the Computer Science Office of the Office of Naval Research. The research included the following specific subjects: Connectionism of Parallel Computers, Exploiting Parallel Processing, Connectedness of Commonsense Knowledge Bases, Connectedness and Society of Mind, Advantages and Deficiencies of Connectionist Networks, Insulation and Interaction, Learning and Representation, Intermediate Units and Significance, Associations and Connections, Unifying Frames and K-lines, Clarifying Conceptual Dependency, Computational linguistics, Research tools for society of mind models, Discovery processes, and Bridges between symbolic and connectionist models.

14082 **(AD-A—200520/5/XAB) Transitive reduction in parallel via branchings. Technical report.** Gibbons, P.; Karp, R.; Ramachandran, V.; Soroker, D.; Tarjan, R. (Illinois Univ., Urbana (USA). Coll. of Engineering). Oct 1988. 19p. (UILU-ENG—88-2254). NTIS, PC A03/MF A01.

This document studies the following problem: given a strongly connected digraph, find a minimal strongly connected spanning subgraph of it. The main result is a parallel algorithm for this problem, which runs in polylog parallel time and uses O(n Cubed) processors on a PRAM. The authors' algorithm is simple, and the major tool it uses is computing a minimum-weight branching with zero-one weights. Also presented are sequential algorithms for the problem that run in time O(m+n logn).

14083 **(AD-A—200521/3/XAB) Parallel restructuring and evaluation of expressions. Technical report.** Muller, D.E.; Preparata, F.P. (Illinois Univ., Urbana (USA). Coll. of Engineering). Oct 1988. 29p. (UILU—88-ENG-2253). NTIS, PC A03/MF A01.

This paper describes a boolean network of size O(N squared log N) which accepts a fully parenthesized N-variable expression over a given semiring and produces its value in O(log N) time. The network consists of two components: a preprocessor and a universal evaluator. The preprocessor computes the destinations of the expression terms and routes them to the correct input terminals of the universal evaluator. The evaluation of tree-structured expressions is a fundamental computation encountered in several problems. The feasibility of parallel computing has attracted considerable research interest to the restructuring of expressions - typically arithmetic expressions - to speed up their evaluation. While restructuring for parallel evaluation has been the main objective for some time, more recently attention has focused on the parallelization of the actual evaluation starting from the original expression itself. Several algorithms have been recently proposed for implementation on the P-RAM model; the most efficient of these algorithms achieve time O(log N) for an N-variable expression, and are either optimal, O(N/log N), or near-optimal, O(N), in the number of processors used. The evaluations of an expression in parallel could be carried out as the combined execution of the restructuring and evaluation tasks.

14084 **(AD-A—200584/1/XAB) Axioms for concurrent objects. Interim report.** Herlihy, M.P.; Wing, J.M. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Computer Science). Dec 1987. 26p. (CMU-CS—86-154). NTIS, PC A03/MF A01.

Specification and verification techniques for abstract data types that have been successful for sequential programs can be extended in a natural way to provide the same benefits for concurrent programs. An approach is proposed to specifying and verifying concurrent objects based on a novel correctness condition, called linearizability. Linearizability provides the illusion that each operation takes effect instantaneously at some point between its invocation and its response, implying that the meaning of a concurrent objects operations can still be given by pre- and post conditions. This paper defines and discusses linearizability, and then give examples of how to reason about concurrent objects and verify their implementations based on their (sequential) axiomatic specifications.

14085 **(ANL/TM—457-Rev.1) Using the Hydra Protocol Converter for IBM full screen terminal emulation at ANL.** Hinds, A.R.; Leibfritz, D.W.; Louie, K.K.; Lurie, G.R. (Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38. 52p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005934/JAW.

The Hydra Protocol Converter is a dedicated microprocessor that allows selected ASCII terminals, and personal computers emulating ASCII terminals, to achieve full screen capabilities similar to IBM 3277 terminals. Through the Argonne Private Branch Exchange (PBX) at extension 2-3270, you can use the Hydra for full screen terminal access to all the central IBM computer interactive services (CMS, MVS Wylbur, CICS, and MVS TSO). These services are more flexible and easier to use if you have full screen terminal capabilities; the Hydra provides excellent emulation of most IBM 3277 terminal features, and it displays the effects of your keystrokes immediately on your terminal screen In addition, the Hydra permits you to transfer files between CMS and personal computers running either the Kermit or RELAY Gold programs. The Hydra communicates asynchronously at communication speeds ranging from 300 baud to 19.2 kilobaud (a baud is one bit, or binary digit, per second). Generally, use the fastest speed (baud rate) that your ADI (Asynchronous Data Interface) or modern and terminal or terminal emulation program can sustain; the Hydra will automatically adjust to the speed you have set. However, at high speeds, the Hydra may overrun your terminal, causing missing, misplaced (garbage) characters on your display. If such characters occur, specify automatic XON/XOFF flow control or try changing to a lower communication rate (see "Setting Your Communication Rate" in the section of Appendix B relevant to your terminal equipment, or the chapter on your terminal.) There are several methods of emulating full screen IBM terminals besides using the Hydra (such as software packages). However, the Hydra is the most efficient method at Argonne. Throughout this document, all mention of full screen emulation refers to emulating IBM 3277-type terminals with the Hydra. 1 fig., 7 tabs.

14086 **(ANL/TM—465) Center for Research Computation [CERC] project report for FY1988.** Walsh, D.J. (ed.); Patterson, J.C.; Bertoncini, P.J.; Greenwell, D.L.; May, E.N.; Sinclair, D.K. (Argonne National Lab., IL (USA)). Dec 1988. Contract W-31109-ENG-38. 52p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005935/JAW.

The advent of high performance parallel computers has opened vistas in the area of what are now thought of as computationally tractable problems. The importance to the scientific computing community of harnessing this processing power in a production mode is widely recognized. Argonne National Laboratory (ANL) has initiated the Center for Energy Research Computation (CERC) Project as a first step toward this goal. The project was designed as a two-year study that will ascertain the feasibility of creating a supercomputer center based on highly parallel machines. This report contains the findings of the CERC Project's first-year efforts. Argonne's research program in advanced scientific computing is recognized as one of the outstanding accomplishments in the Department of Energy's Basic Energy Sciences program. The Advanced Computing Research Facility (ACRF), which the Mathematics and Computer Science Division (MCS) operates and makes available to the computer science community, has established the reputation of the Laboratory in this area of high technology. Researchers in MCS and the Computing and Telecommunications Division (CTD) are convinced that multiprocessing will be the primary means of achieving supercomputer power in the future. They also believe that the time has come to transfer to the energy research community some of the expertise gained in advanced computing research. A demonstration of the capabilities of multiprocessors on realistic problems has already begun and is starting to provide evidence of the potential of multiprocessing for large-scale scientific computations. In FY1988 the CERC project selected and parallelized ANL codes in the following areas: quantum chromodynamics, molecular dynamics, fluid dynamics, and high energy physics. In the process of adapting these codes for parallel processing, the project developed requisite tools for implementing parallel Fortran programs and for debugging programs on distributed-memory systems.

14087 (CERN—88-03) 1987 CERN School of Computing: Proceedings. Verkerk, C. (ed.). (European Organization for Nuclear Research, Geneva (Switzerland)). 8 Jun 1988. 428p. (CONF-8709308—). CERN, European Organization for Nuclear Research, CH-1211, Geneva, Switzerland. Order Number TI88013866/JAW.

From CERN school of computing; Troia, Portugal (13 Sep 1987).

These Proceedings contain written versions of most of the lectures delivered at the 1987 CERN School of Computing. Five lecture series treated various aspects of data communications: integrated services networks, standard LANs and optical LANs, open systems networking in practices, and distributed operating systems. Present and future computer architectures were covered and an introduction to vector processing was given, followed by lectures on vectorization of pattern recognition and Monte Carlo code. Aspects of computing in high-energy physics were treated in lectures on data acquisition and analysis at LEP, on data-base systems in high-energy physics experiments, and on Fastbus. The experience gained with personal work stations was also presented. Various other topics were covered: the use of computers in number theory and in astronomy, fractals, and computer security and access control.

14088 (CONF-881120—20) State-of-the-art digital data acquisition system. Scudiere, M.B.; Adams, D.J.; Beshears, D.L.; Capps, G.J.; Jordan, J.K.; Napier, R.W.; Ott, G.W.; White, C.P.; Nodine, R.N.; Todd, R.A. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005336/JAW.

From ASME winter annual meeting; Chicago, IL, USA (28 Nov 1988).

The torpedo data acquisition (TORDAC) system is a stand-alone, transportable data acquisition system, packaged to fit into a torpedo-sized vehicle, and is designed to record a mix of user-selectable analog and digital data. TORDAC calibrates, conditions, digitizes, and records multiple channels of analog voltage outputs generated by arrays of vehicle sensors and it also records digital data streams from on-board digital processors. The maximum write speed of the system is 107 Mb/s (one hour duration) which provides a recordable analog bandwidth in excess of 1800 kHz with 96-dB resolution. Configuration of analog signal inputs is flexible; a typical configuration will record 60 wide-band channels [sampled at 100 kHz with a 16-bit analog-to-digital (A/D) converter] and 56 narrow-band channels (sampled at 1.5 kHz with a 12-bit A/D converter). TORDAC also generates programmable output signals (to control internal or external functions) based on the status of inputs being recorded. Operator control of the system for setup, checkout, playback, data validation, and data reduction is performed on networked computer workstations. Dedicated hardware is provided to reconstitute all analog voltage waveforms in real time (from recorded digitized data) to permit quick-look data validation. 14 figs., 1 tab.

14089 (DOE/ER/25046—1) Measuring performance of parallel computers: Annual progress report. Sullivan, F. (National Inst. of Standards and Technology, Gaithersburg, MD (USA). Center for Computing and Applied Mathematics). 1988. Contract AI05-87ER25046. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005956/JAW.

The major questions needing to be answered are: how can codes be improved? what kind of codes should be run on what kind of machine? Our point of view is that data motion is the principal determining factor in the performance of algorithms on parallel machines. Our approach to performance measurement has been to first develop a taxonomy for algorithmic paradigms based on how the data moves during the calculation, rather than on what the specific computational steps are. Thus, from this viewpoint, "Ising spin simulations" occur in two different places in the taxonomy as "applications," depending on which algorithm is to be used. Benchmark codes typical of applications in each class of the taxonomy have been developed and implemented on different parallel computers in order to explore the relations between the taxonomy and the "machine event level" of a layered framework or spectrum. The upper level is the applications which dictate the required computational load. The lowest level is machine events, memory and communication links, having capabilities that should satisfy the upper level requirements. 14 refs.

14090 (FNAL/C—88/166) Crossbar switch backplane and its application. Atac, R.; Cook, A.; Deepe, J.; Fischler, M.; Gaines, I.; Husby, D.; Nash, T.; Pham, T.; Zmuda, T.; Eichten, E. (Fermi National Accelerator Lab., Batavia, IL (USA)). Nov 1988. Contract AC02-76CH03000. 5p. (CONF-881103—28). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005621/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

A crossbar switch backplane design (Bus Switch Backplane) based on TI's crossbar switch chip is described. This backplane holds a maximum of 16 modules and allows simultaneous communications between up to 8 pairs of modules. The aggregate data transfer rate on the backplane is 160 Mbyte/sec. The Bus Switch Backplane is an essential part of the ACP Multi Array Processor, a supercomputer for site oriented problems. The first application of this machine is in Lattice Gauge Theory calculations. The Bus Switch Backplane also finds ready application in data acquisition schemes based on the ACP multi-microprocessor system. 4 refs., 8 figs.

14091 (GAO/NSIAD—88-180FS) Strategic defense initiative program. (General Accounting Office, Washington, DC (USA). National Security and International Affairs Div.). 1988. 12p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

The Strategic Defense Initiative Organization's National Test Bed is to provide a computer-based simulation capability to assess strategic defense systems without actually building or deploying such a system. It can potentially provide the data considered necessary for a full-scale development program decision in the early 1990s that can increase confidence and support judgments about a strategic defense system's military effectiveness, survivability, and cost-effectiveness. However, delays in contract implementation, program objectives to establish an early analysis capability, and construction have been experienced. It is too early to determine the effect of these delays on the overall SDI program.

14092 (INFO—0224) Conversion of CATHENA from the VAX to APOLLO computer. Kawa, D.M. (Wardrop Engineering Consultants, Winnipeg, Manitoba (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Dec 1986. 56p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705131/JAW.

The thermal-hydraulic computer code developed by Atomic Energy of Canada Limited, CATHENA, has been converted from the VAX computer to operate on a low-cost, high-performance APOLLO 3000 work station. Full functionality of the program has been retained. Three verification cases have been analyzed which indicate accuracy to the sixth decimal place as printed in output listings. The APOLLO 3000 computing times for the 3 cases are approximately 15% faster than achieved on the Wardrop VAX 11 750.

14093 (JAERI-M—88-143) Investigation of knowledge structure of nuclear data evaluation code. Uenaka, Junji; Kambayashi, Shaw. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 71p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756558/JAW.

In this report, investigation results of knowledge structure in a nuclear data evaluation code are described. This investigation is related to the natural language processing and the knowledge base in the research theme of Human Acts Simulation Program (HASP) begun at the Computing Center of JAERI in 1987. By using a machine translation system, an attempt has been made to extract a deep knowledge from Japanese sentences which are equivalent to a FORTRAN program CASTHY for nuclear data evaluation. With the knowledge extraction method used by the authors, the verification of knowledge is more difficult than that of the prototyping method in an ordinary AI technique. In the early stage of building

up a knowledge base system, it seems effective to extract and examine knowledge fragments of limited objects.

14094 (Juel-Spez—458, pp 100-123) **Developments of programs for the guidance of the experimental logics and the data acquisition.** Kraemer-Flecken, A. Jul 1988. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756513/JAW.

In Studies on the decay of high-spin isomers in the W and Os isotopes and developments of programs for the guidance of the experimental logics and the data acquisition.

The new status of technique allows to construct the experimental electronics by the application of ECL modules essentially faster. By the use of the old CAMAC standard it is possible to calibrate experiment configurations by means of a calculator. New techniques in the fabrication of microprocessors and storage -IC's allow the use of microprocessors for the guidance of the experiment electronics and contribute to the creation of an independent on large calculators, modular, and transportable computer. For the calibration of complex detector systems new CAMAC plug-in's exist which allow a data acquisition on the CAMAC bus. With the new eightfold ADC's precision measurements can be perormed. An upgrading of such small data acquisition systems under inclusion of the VME bus is very soon realizable. By this nuclear spectroscopic experiments can be performed essentially more simply. (HSI).

14095 **(LA—11465-MS) Los Alamos National Laboratory computer benchmarking 1988.** Wasserman, H.J. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005979/JAW.

This report summarizes the results of computer performance evaluations as measured by the Computer Research and Applications Group of the Los Alamos National Laboratory. The benchmarks were conducted between December 1986 and July 1988. Important characteristics of the machines tested are given, and execution times or megaflop rates for a set of portable Fortran 77 benchmark codes are listed. A brief description of the codes is included. Tests were performed on the following computers: Cray Research Inc. CRAY-1S, X-MP/24,X-MP/48, X-MP/416,X-MP/SE, Y-MP/832, and CRAY-2; ETA Systems Inc. ETA-10; NEC SX/2; Hitachi S-820/80; Convex Computer Corporation C-1XP; Alliant Computer Systems Corporation FX/8 and FX/80; Scientific Computer Systems SCS-40; and the Multiflow Computer, Inc., Trace-7/200. Only single-processor tests are reported, except for the Alliant FX/8 and FX/80. 20 refs., 8 tabs.

14096 **(MLM-MU—89-61-0009) A personal computer program to transfer MultiMate files to automated office system documents.** Kern, J.N. (EG and G Mound Applied Technologies, Miamisburg, OH (USA)). 27 Jan 1989. Contract AC04-88DP43495. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005973/JAW.

A personal computer/disk operating system program, MultiMate to DEC WPS (MMWPS), was developed to read a MultiMate DOC file, interpret it into an ASCII text stream, then type it out the serial port at the baud rate and other serial port parameters specified when the program began. This program provides a simple way to incorporate a MultiMate document into the automated office system editor, WPS-Plus. 2 refs.

14097 **(MLM-MU—89-61-0010) A personal computer program to transfer documents from the automated office system to MultiMate disk files.** Kern, J.N. (EG and G Mound Applied Technologies, Miamisburg, OH (USA)). 27 Jan 1989. Contract AC04-88DP43495. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005974/JAW.

A program, WPS to MultiMate file transfer (WPSMM), was developed to collect text from the WPS-Plus editor of the automated office system (AOS), interpret it into an ASCII text stream, translate it to a MultiMate DOC file format, then write it out to a personal computer disk drive. The program communicates with AOS using the serial port of the computer at the baud rate and other parameters specified when the program began. This program provides a simple way to create a MultiMate document from a document in the AOS editor, WPS-Plus. 1 ref.

14098 **(N—89-13145) Performance analysis of the Alliant FX/8 multiprocessor using statistical clustering.** Dimpsey, R.T. (Illinois Univ., Urbana (USA)). Nov 1988. 39p. (NASA-CR—183221; NAS—1.26:183221; UILU-ENG—88-2255; CSG—91). NTIS, PC A03/MF A01.

Results for two distinct, real, scientific workloads executed on an Alliant FX/8 are discussed. A combination of user concurrency and system overhead measurements was taken for both workloads. Preliminary analysis shows that the first sampled workload is comprised of consistently high user concurrency, low system overhead, and little paging. The second sample has much less user concurrency, but significant paging and system overhead. Statistical cluster analysis is used to extract a state transition model to jointly characterize user concurrency and system overhead. A skewness factor is introduced and used to bring out the effects of unbalanced clustering when determining states with important transitions. The results from the models show that during the collection of the first sample, the system was operating in states of high user concurrency approximately 75 percent of the time. The second workload sample shows the system in high user concurrency states only 26 percent of the time. In addition, it is ascertained that high system overhead is usually accompanied by low user concurrency. The analysis also shows a high predictability of system behavior for both workloads.

14099 **(N—89-13202) Solution of linear systems of equations with a structural analysis code on the NAS CRAY-2.** Poole, E.L.; Overman, A.L. (Awesome Computing, Inc. (USA)). Dec 1988. 33p. (NASA-CR—4159; NAS—1.26:4159). NTIS, PC A03/MF A01.

Two methods for solving linear systems of equations on the NAS Cray-2 are described. One is a direct method; the other is an iterative method. Both methods exploit the architecture of the Cray-2, particularly the vectorization, and are aimed at structural analysis applications. To demonstrate and evaluate the methods, they were installed in a finite element structural analysis code denoted the Computational Structural Mechanics (CSM) Testbed. A description of the techniques used to integrate the two solvers into the Testbed is given. Storage schemes, memory requirements, operation counts, and reformatting procedures are discussed. Finally, results from the new methods are compared with results from the initial Testbed sparse Choleski equation solver for three structural analysis problems. The new direct solvers described achieve the highest computational rates of the methods compared. The new iterative methods are not able to achieve as high computation rates as the vectorized direct solvers but are best for well conditioned problems which require fewer iterations to converge to the solution.

14100 **(ORNL/M—590) Technology applications bulletins, Fall 1988.** Koncinski, W. Jr.; McKeehan, K. (eds.). (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 62p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005677/JAW.

Martin Marietta Energy Systems, Inc. (Energy Systems), operates five facilities for the US Department of Energy (DOE). Much of the research carried out at these facilities is of interest to industry and to state or local governments. To make information about this research available, the Energy Systems Office of Technology Applications publishes brief descriptions of selected technologies and reports. These technology applications bulletins describe the new technology and inform the reader about how to obtain further information, gain access to technical resources, and initiate direct contact with Energy Systems researchers. The general topics covered in this report are: artificial intelligence, robotics, and manufacturing processes; measurements and controls; energy conservation; environmental technology; chemical and waste management; energy production; and advanced materials.

14101 **(SAND—88-0634) Computing at SNL: "The way it should be" - circa 1993.** Daigle, D.; Fine, L.; McGlaun, M.; Pierson, L.; Sears, M.; Seidel, D.; Sheaffer, K.; Vandevender, W.; Voelker, G. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1988. Contract AC04-76DP00789. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006002/JAW.

This document depicts a dynamic, laboratory-wide, integrated computing environment, the Sandia Laboratories Integrated Computing Environment (SLICE), of supercomputers, applications, application servers, computer servers, file servers, file storage devices, workstations and communication networks that serves the technical computing needs for the diverse Sandia National Laboratories user community. SLICE provides a stable, unified, user-friendly computing environment for the entire laboratory, yet utilizes state-of-the-art hardware and software as quickly as budgets, manpower and security restrictions allow.

14102 **(SAND—88-2301) User's guide: Software support packages for SANDAC V/MIL-STD-1553B interface.** Richards, S.C. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1989. Contract AC04-76DP00789. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006363/JAW.

This report contains the software support packages currently available for the SANDAC V MIL-STD-1553B interface. Use of these packages allows those developing a specific application to use the MIL-STD-1553 bus without requiring the programmer to become intimately involved with the interface hardware. 7 refs.

14103 **(SLAC-PUB—4766-Rev.) PASHA: An approach to computer-aided hardware debugging.** Agostini, R.C.; Walz, H.V.; Gustavson, D.B.; Barker, L. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1988. Contract AC03-76SF00515. 2p. (CONF-881103—7-Rev.). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006065/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

An interactive computer-aided diagnostic tool for the SLAC FASTBUS SNOOP has been developed. The distributed soft-ware package, written in FORTH and executing concurrently on an IBM PC and on the SNOOP, automatically tests the board and allows pinpointing faults by running a set of specific tests. Special attention has been given to the menu-driven man-machine interface which guides the use through the debugging session. Details of the design and results of field trials are reported. 5 refs., 6 figs.

14104 **(UCRL—98839) Distributed terminal interaction using LINCS.** Fletcher, J.G. (Lawrence Livermore National Lab., CA (USA)). 31 May 1988. Contract W-7405-ENG-48. 10p. (CONF-890229—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89001219/JAW.

From CompCon Spring '89: Institute for Electrical and Electronics Engineers (IEEE) Computer Society meeting; San Francisco, CA, USA (27 Feb 1989).

The LINCS architecture for a distributed computing system defines a protocol for interacting with a terminal, in particular for logging in and logging out. This protocol is described, showing how it permits the various modules involved---the interactive terminal, the authenticator, the command language interpreters, and the application---to be distributed onto different computers. 2 refs., 2 figs.

14105 **(UCRL—98958) Guesting UNIX in a distributed operating system.** Lee, G.M. (Lawrence Livermore National Lab., CA (USA)). 17 Jun 1988. Contract W-7405-ENG-48. 13p. (CONF-890250—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005612/JAW.

From USENIX '89 winter conference; San Diego, CA, USA (1 Feb 1989).

One solution to the problem of integrating a UNIX host into the terminal services of a distributed operating system is to guest the distributed operating system services on the UNIX system with software that runs on the host and translates between the terminal services of the host and those of the distributed operating system. An example of such an interface was created for use at the Lawrence Livermore National Laboratory. Design issues and decisions preceding software development are discussed, followed by details of software operation. Lessons learned during development that would be applicable to a similar effort are given. 9 refs., 10 figs.

14106 **(UCRL—99839) Logon in distributed systems.** Nessett, D. (Lawrence Livermore National Lab., CA (USA)). 20 Oct 1988. Contract W-7405-ENG-48. 6p. (CONF-890229—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002285/JAW.

From CompCon Spring '89: Institute for Electrical and Electronics Engineers (IEEE) Computer Society meeting; San Francisco, CA, USA (27 Feb 1989).

The problem of logon in distributed systems is discussed. The use of central authentication to solve this problem is described and justified. A layering technique that allows the addition of central authentication to vendor-supplied operating systems is presented and experience with this technique is given. 11 refs., 4 figs.

14107 **The parallel complexity of exponentiating polynomials over finite fields.** Fich, F.E.; Tompa, M. (Dept. of Computer Science, Univ. of Toronto, Toronto, Ontario M5S 1A4 (CA));. *Journal of the Association for Computing Machinery;* **31**: No. 9, 1143(Jul 1988).

Modular integer exponentiation (given a, e, and M, compute a/sup e/ mod m) is a fundamental problem in algebraic complexity for which no efficient parallel algorithm is known. Two closely related problems are modular polynomial exponentiation (given a(x), e, and (m(x), compute (a(x))/sup e/ mod m(x)) and polynomial exponentiation (given a(x), e and t compute the coefficient of x/sup t/ in (a(x))/sup e/). It is shown that these latter two problems are in NC/sup 2/ when a(x) and m(x) are polynomials over a finite field whose characteristic is polynomial in the input size.

14108 **Latent failures due to electrostatic discharge in CMOS integrated circuits.** Gammill, P.E.; Soden, J.M. (Sandia National Labs., Albuquerque, NM (US));. pp v of Electrical overstress/electrostatic discharge symposium proceedings. 1986. Chicago, IL; Illinois Institute of Technology (1987). (CONF-8609149—).

From Electrical overstress/electrostatic discharge symposium; Las Vegas, NV, USA (23 Sep 1986).

Electrostatic discharge (ESD) caused two CMOS integrated circuits (ICs) to fail in a latent manner due to gate oxide rupture. One failure occurred during an experiment designed to test for latent failures where a set of ICs was subjected to simulated electrostatic discharge (VZAP) followed by life testing. Another failure occurred during the operation of a system being readied for a satellite application.

14109 **Phenomenology of pulse failure thresholds in a small signal diode.** Orvis, W.J.; Yee, J.H.; Khanaka, G.H. (Lawrence Livermore National Lab., Livermore, CA (US));. pp v of Electrical overstress/electrostatic discharge symposium proceedings. 1986. Chicago, IL; Illinois Institute of Technology (1987). (CONF-8609149—).

From Electrical overstress/electrostatic discharge symposium; Las Vegas, NV, USA (23 Sep 1986).

The curves of diode failure threshold energy generated with the one-dimensional, solid state device model BURN42 are not simple. This is especially true of the curves of diode failure threshold energy versus frequency, which decrease with frequency for long pulses and increase with frequency for short pulses. The cause of this phenomena is due to selective heating of device, either in the active region or in the substrate. If the heating is in the small active region, then it will take only a small amount of energy to cause the temperature to rise to the failure level (800 K assumed in this report). If the heating is in the substrate, it will take more energy since it has a larger volume. The switching between heating in the junction of the substrate is controlled by several processes, all of which result in forcing the electric field to be in or out of the junction, which determines where the heating will take place.

14110 **A systolic array for efficient execution of the Faddeev algorithm.** De Groot, A.J.; Johansson, E.M.; Parker, S.R. (Lawrence Livermore National Lab., Livermore, CA (US));. pp v of Real time signal processing X. Letellier, J.P. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1987). (CONF-8708207—).

From 10. real time signal processing; San Diego, CA, USA (20 Aug 1987).

The Systolic Processor with a Reconfigurable Interconnection Network of Transputers (SPRINT) is a sixty-four-element multiprocessor developed at Lawrence Livermore National Laboratory to evaluate systolic algorithms and architectures experimentally. The processors are interconnected in a reconfigurable network which can emulate networks such as the two-dimensional mesh, the triangular mesh, the trapezoidal mesh, the tree, and the shuffle-exchange network. The SPRINT's computation capability surpasses its communication capability. Techniques have been developed to perform the Faddeev Algorithm utilizing most of its computing capability by operating on block matrices. These techniques reduce communication bandwidth requirements for a given computation rate and increase efficiency to close to 100%. The Faddeev algorithm calculates the quantity CX+D, where X is the solution to AX=B, and where A, B, C and D are given. All quantities are square matrices. Several linear algebra operations such as the matrix-matrix product and matrix inversion can be calculated by loading appropriate values for A, B, C, and D. The Faddeev algorithm is executed on the SPRINT to compare theory with experiment.

14111 **Application of knowledge based systems technology to triple quadrupole mass spectrometry (TQMS).** Brand, H.; Wong, C. (Lawrence Livermore Lab., Livermore, CA (US));. pp v of Proceedings of AAAI-86 fifth national conference on artificial intelligence. Volume 1: Science. Menlo Park, CA; American Assn. of Artificial Intelligence (AAAI) (1986). (CONF-860848—).

From AAAI '86: 5th national conference on artificial intelligence; Philadelphia, PA, USA (11 Aug 1986).

The complexity of chemical instrumentation is such that automation of certain instrument functions by conventional algorithmic means is either very difficult or completely unsuitable. This paper details work in progress on the application of knowledge based systems technology to the tuning of a complex analytical instrument, a triple quadrupole mass spectrometer (TQMS). The knowledge representation schemes and interface design between the expert system and the TQMS instrument are discussed. Preliminary results of optimizing the TQMS on chemical standards are presented.

9903 Information Handling

REFER ALSO TO CITATION(S) 12984, 13312, 13582, 14093

14112 **(AD-A—200416/6/XAB) Implementation of a parallel multilevel secure process. Master's thesis.** Pratt, D.R. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1988. 117p. NTIS, PC A06/MF A01.

This thesis demonstrates an implementation of a parallel multilevel secure process. This is done within the framework of an electronic-mail system. Security is implemented by GEMSOS, the operating system of the Gemini Trusted Computer Base. A brief history of computer secrecy is followed by a discussion of security kernels. Event counts and sequences are used to provide concurrency control and are covered in detail. The specifications for the system are based upon the requirements for a Headquarters of a hypothetical Marine Battalion in garrison.

14113 **(CRN-PN—87-21) Choice of a server. Examination of criteria, justification of the choice of the XMS 3020 series 4.** Wittmer, P.; Michaud, J.D.; Muser, A.; Zen, J.; Zehnacker, G. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). Oct 1987. 30p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756669/JAW.

It is shown that the XMS 3020 series 4 system in a given configuration for scientific utilization has the necessary calculating power, memory, architecture, and UNIX implementation to serve around 30 users with good response time. For SUN machines, which have a distributed architecture, six black and white and one color graphics workstation were integrated into the system, for quick two and three dimensional graphics. The ETHERNET network will be extended to the whole research center.

14114 **(LA-UR—88-3903) The high-speed channel (HSC) standard.** Tolmie, D.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-890229—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003558/JAW.

From CompCon Spring '89: Institute for Electrical and Electronics Engineers (IEEE) Computer Society meeting; San Francisco, CA, USA (27 Feb 1989).

The High-Speed Channel (HSC) is a simple high-performance, point-to-point channel for transmitting digital data at peak data rates of 800 or 1600 Mbit/s. The transmission distance between data-processing equipment using copper cabling can be up to 25 meters. A distance-independent protocol allows the average data rate to approach the peak data rate. This is a benefit for future, fiber-optic versions of the HSC. The HSC and its uses are described, followed by a description of the efforts for an American National Standards Institute (ANSI) standard for the HSC. 3 figs.

14115 **(SAND—86-0503) Interagency information study: Final report.** (Sandia National Labs., Albuquerque, NM (USA)). Dec 1988. Contract AC04-76DP00789. 67p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006000/JAW.

This report describes the interagency information needs of the Nuclear Weapons Complex (NWC). Information systems that satisfy these needs are detailed and prioritized, and an incremental implementation plan is presented. It also covers information systems planning in general and describes the major results of the Interagency Information Study (IIS). The information model is described in detail with examples of the data maintained in the IIS data base. 5 figs., 2 tabs.

9904 Law

REFER ALSO TO CITATION(S) 14073

14116 **(IAEA-TECDOC—485) Analysis of replies to an IAEA questionnaire on regulatory practices in Member States with nuclear power programmes. Summary report.** (International Atomic Energy Agency, Vienna (Austria)). Oct 1988. 65p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705335/JAW.

The survey of regulatory practices in Member States with nuclear power programmes by means of a questionnaire is the first stage of the programme developed by the IAEA to assist the Member States in the enhancement of their regulatory practices. The questionnaire, drafted by IAEA staff members and consultants, consisted of 120 detailed questions and its structure corresponds approximately to the Structure of Code on the Safety of Nuclear Power Plants: Governmental Organizations (IAEA Safety Series No. 50-C-G-Rev.1). The questionnaire was sent to 64 Member States on 7 July 1987 and the replies received from 44 Member States have been analysed by IAEA staff members with the assistance of two consultants in order to identify the main differences in approach and the important features of regulatory practices in Member States. This technical document is the summary report of this analysis.

14117 **(INFO—0201) Computer software quality assurance.** Ives, K.A. (Prior Data Sciences Ltd., Toronto, Ontario (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jun 1986. 80p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705125/JAW.

The author defines some criteria for the evaluation of software quality assurance elements for applicability to the regulation of the nuclear industry. The author then analyses a number of software quality assurance (SQA) standards. The major extracted SQA elements are then discussed, and finally specific software quality assurance recommendations are made for the nuclear industry.

9905 Civilian Defense

REFER ALSO TO CITATION(S) 14065

14118 (AD-A—200442/2/XAB) Megawatt space-power conditioning, distribution, and control study. Final report, September 1985-September 1987. Morgan, W.T. (TRW Space and Technology Group, Redondo Beach, CA (USA)). Mar 1988. 192p. (TRW—46568-912). NTIS, PC A09/MF A01.

This study defined appropriate methodologies for conditioning, distribution, and controlling prime electrical power for megawatt-level directed- and kinetic-energy weapons and identified mission-critical and mission-enabling technologies. The methodology used was: a. Identify candidate payloads, b. Identify candidate power sources, c. Create a system to interconnect the source and load, d. Estimate the weight of the system, and e. Evaluate the selected system against other candidate systems. The key issue identified is the necessity to match the generator to the load with minimum power conditioning equipment. Every additional piece of equipment placed in the power-transmission chain adds substantially to the weight. High-voltage transmission is clearly desirable, even though any terminations or exposed parts must be isolated from the space plasma. Only low-current (a few hundred amps or less) transmission/distribution lines lend themselves to being uncooled. Everything higher in current probably requires at least some cooling. Development needs include either a high-voltage generator or an efficient generator/transformer combination that can produce high voltage. This latter combination requires either a high-frequency generator, or a light-weight transformer, or both. All of the systems require either ac/dc converters (rectifiers) or dc/dc converters (inverter/rectifiers).

14119 (CONF-881249—2) Air Force budget analysis and forecasting system. Jairam, B.N.; Hardee, H.K.; Morris, J.D.; Emrich, M.L. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004911/JAW.

From National Governor's Association meeting: finding the future conference; Washington, DC, USA (12 Dec 1988).

A primary mission of the Budget Management Division of the Air Force is fiscal analysis and forecasting. This involves formulating and tracking financial data, as well as justifying anomalous behavior. The process of analysis and forecasting relies heavily on historical data, which forms the basic guideline for predicting future trends. An essential requirement of this process is the ready availability and manipulation of past and current budget data. This necessitates the decentralized availability of information. This paper presents a prototypical system, BAFS (Budget Analysis and Forecasting System) that provides such capabilities. In its current state, the system is designed to be a financial forecasting and evaluation tool. A brief report of the budget decisions and activities is presented. The system structure and its major components are highlighted. Implementation strategies and future enhancements are discussed. 7 refs., 7 figs.

14120 (LA—11364-MS) Neutral particle beams in strategic defense. Canavan, G.H.; Browne, J.C. (Los Alamos National Lab., NM (USA)). Jan 1989. Contract W-7405-ENG-36. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006566/JAW.

This report summarizes the main elements of the current Strategic Defense Initiative program, its major risks, and the role neutral particle beams could play in reducing these risks. 13 refs., 4 tabs.

14121 (LLNL—9005949) French attitudes concerning major contemporary issues affecting European security. Zinner, P.E. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005949/JAW.

While in Europe this past summer, Prof. Zinner had an interesting opportunity to meet in Paris with a number of highly placed French officials concerned with national security affairs. Their views seemed to me to be of sufficient interest and different in such significant ways from those expressed by FRG officials that I asked Paul to prepare a brief summary. This paper does just that and speaks for itself. This paper is part of a continuing program of studies funded by the Office of Arms Control/DP/DOE and conducted by D Division.

14122 (ORNL/TM—10785) Methodology for coupling the air and ground modules in the state-of-the-art contingency analysis code. Smith, O.L. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005676/JAW.

This report describes the development of a methodology to couple the air and ground modules of the State-of-the-Art Contingency Analysis (SOTACA) code. Important conceptual differences between the air and ground modules that must be bridged include the overall measure of battle progress used in the ground module versus its absence in the air module and the use of pairwise comparisons to measure attrition in the ground module versus the use of probability-of-detection/probability-of-kill parameters in the air module. To provide an overall measure of battle progress, all ground and air confronters are included in the power and vulnerability valuation procedure of the ground module. The air and ground module attrition methodologies are cast in a common format that allows them to be directly summed. Coding changes for the coupling procedure basically reflect changes in parameterization of the existing methodologies rather than reconceptualization. The procedure is examined in a test case. 2 refs., 10 figs., 9 tabs.